ENGINEERING NEWS-RECORD

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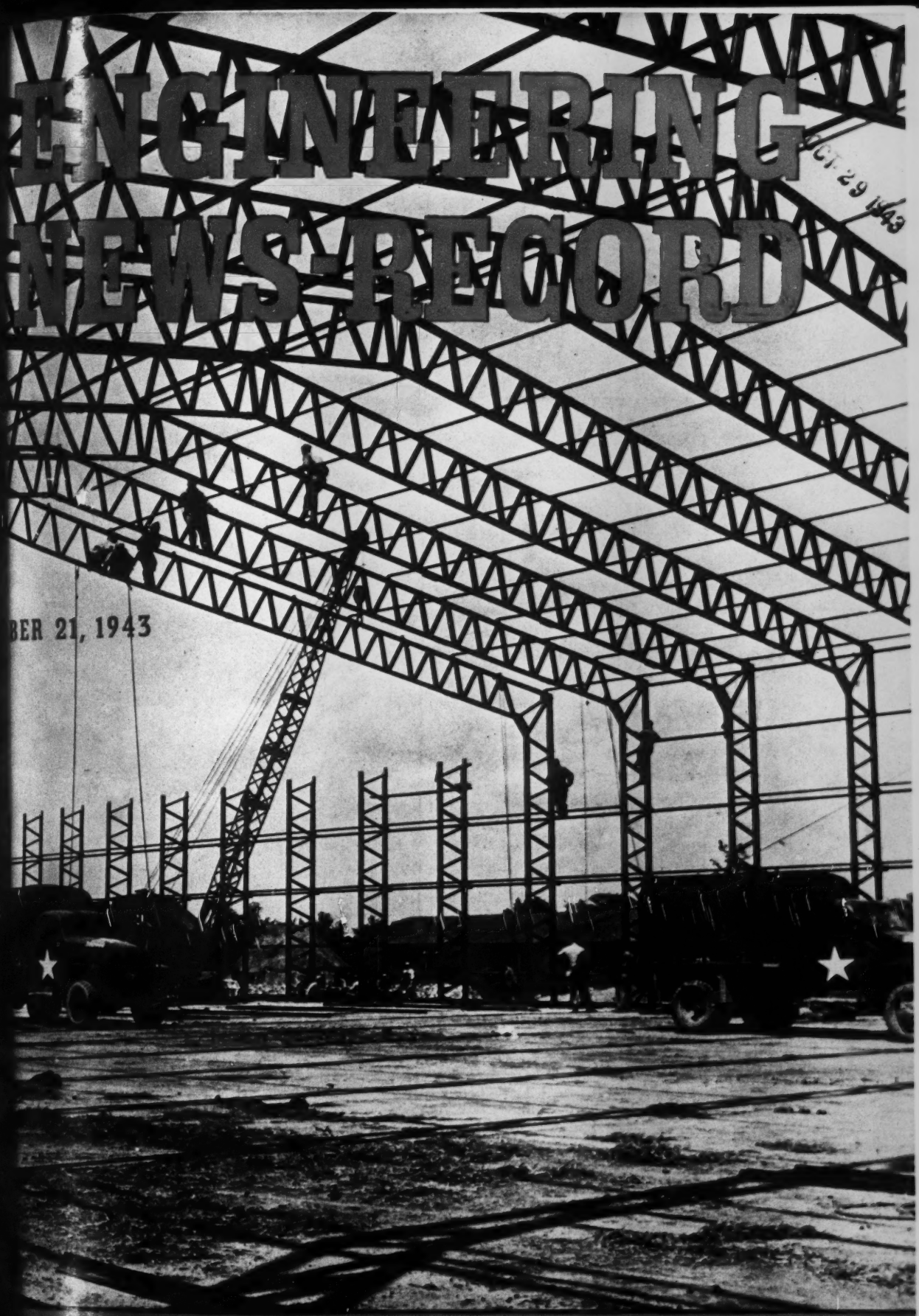
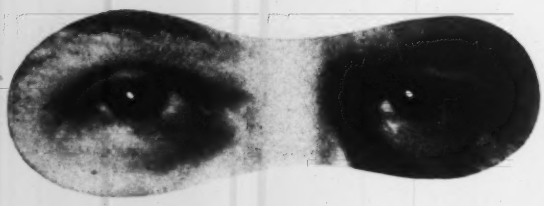


Section on **BUILDINGS AT HOME AND ABROAD**



FOR SEWER ENGINEERS

WHO ARE LOOKING AHEAD

Future-thinking engineers will be interested in this airport drainage story: Engineering integrity demanded a pipe with safe strength to handle heavy loads. Since the port was to continue in use after the war, economy dictated that the system be as durable as possible. Designers solved the problem with Asbestos-Bonded Paved Pipe.

The flexible corrugated metal design of ARMCO Pipe prevents breakage; and band couplers make for strong, tight joints. Longer lengths and fewer joints mean lower installation costs. Cradling is unnecessary. Corrosion is shackled by a full bituminous coating tightly bonded to the base metal. A thick bituminous pavement checks erosion—makes the bottom last as long as the top.

It will pay you well to keep Asbestos-Bonded ARMCO Sewer Pipe in mind for post-war projects even though you may not be able to get it for immediate construction. After the war it again will be available to help solve your toughest sewer problems. Armco Drainage Products Assn., Middletown, O.

★ ★ ★ ★

ASBESTOS-BONDED
ARMCO SEWER PIPE

ENGINEERING NEWS-RECORD

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JOHN ABBINK, *Publisher*

WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

Vol. 131 OCTOBER 21, 1943 No. 17

COMING NEXT

• The value of zinc as a metallic coating, such as galvanizing, and as pigments in metal protective paints has long been known to the construction industry. Recently, there have been major developments in these paints that are worthy of note. In "How Zinc Saves Steel from Rusting" —*ENR* Nov. 4, these developments are summarized and the most efficient utilization of zinc pigments for this purpose is outlined.

• If you read Waldo Bowman's story in the Oct. 7 issue on "Beating a Path to Russia's Back Door," you will not want to miss "Mud, Straw, Bally Poles and Brick," in *ENR* Nov. 4, in which the various types of structures built along the Persian Gulf supply route are described. The many ancient construction practices of the Persians adopted by U. S. Engineers will prove intriguing.

• Competition to provide a more economical design of munition storage facilities, stimulated by introductions of the "Beehive" type igloo, (*ENR* Mar. 26, 1942, p. 498), has resulted in simplification of design and reduction of metal in both the standard type magazine and the beehive igloo. New design data and comparative studies of the two types of structures will be published in the Nov. 4 issue.

LOOKING AHEAD

• Completion of the $14,000,000 MacArthur Lock at the Soo in 14 months sets a new record for lock construction. It also marks an important milestone in the progress of Great Lakes transportation. Not only is the project of interest because of the speed with which it was constructed, but also because of the many innovations introduced in the design of the operating facilities. In an early issue these design features will be described and all major construction problems discussed.

• Protection of Water-Cooled Equipment—an article scheduled for the Nov. 18, issue—will be of particular interest to those contractors operating large fleets of trucks and other water-cooled construction equipment. A number of important suggestions are made for the proper installation, testing and servicing of anti-freeze solutions.

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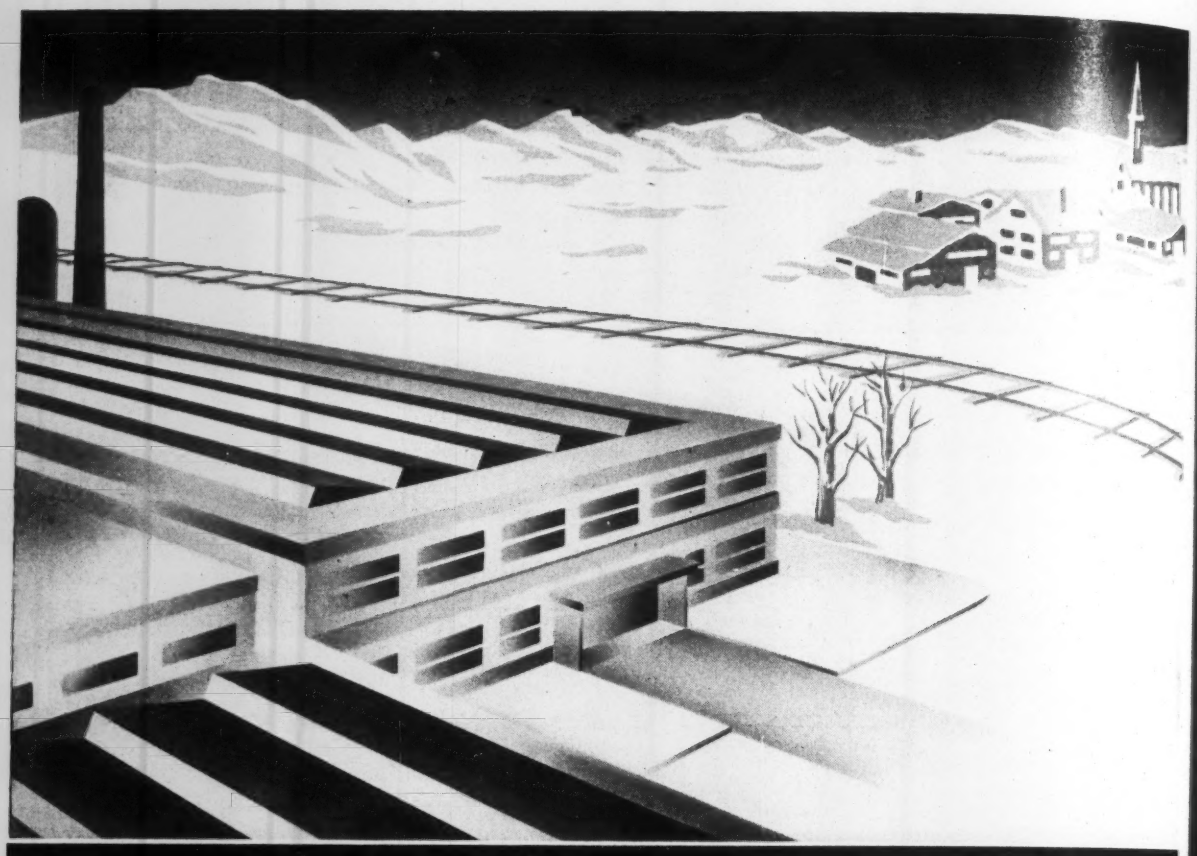

How to raise a plant in WINTER . . . at wartime speed!

It's winter. It's cold. A vital war plant must be built *quickly*. If this job were yours, how would you get it ready on time?

One way to get the best of winter weather and to meet wartime construction schedules is to use Atlas High-Early cement. It gains strength rapidly and produces serviceable concrete in much less time than is required with normal portland cement. Forms often can be stripped in twenty-four hours instead of the customary 3 to 5 days . . . and then reused again. Heating, protection, and curing time is slashed as much as 70%.

Atlas High-Early often saves costs too . . . costs of forms, of equipment, of heating, and of manpower.

You can depend on Atlas High-Early this winter wherever time and labor savings are essential. Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, New York.

* * *

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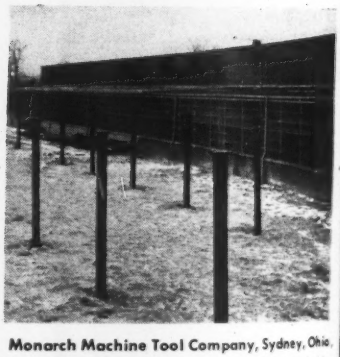


Monarch Machine Tool Company, Sydney, Ohio, needed a sizable addition to their plant by April 1. Work started January 17. The contractor chose Atlas High-Early cement. Mean temperature during concrete placement stayed below freezing—fell as low as 10°F. Concreting was completed thirteen days ahead of original schedule date.

SAVE TIME IN WARTIME WITH

Atlas High-Early Cement

A UNIVERSAL ATLAS PRODUCT

The Week In Engineering and Construction

GINEERING NEWS-RECORD • OCTOBER 21, 1943 • VOLUME 131 • NUMBER 17

Wage board reconstituted to handle private work

Adjustment of wage disputes on private construction operations transferred from War Labor Board to expanded Wage Adjustment Board

Daniel W. Tracy, Assistant Secretary of or, has been named by Secretary of or Frances Perkins as chairman and lic member of the reconstituted Wage stment Board which, under its new -member, tri-partite set-up (*ENR*, 12, 1943, p. 241; Oct. 14, p. 565), now have jurisdiction in private as as government wage dispute cases. ate project adjustments were for- y handled by the War Labor Board. change is made in view of changing truction conditions under which the ber of public projects is decreasing private construction is increasing. gar L. Warren, chief of the review analysis section of the WLB's Wage ilization Division, was appointed a ic member to represent WLB. The public member will be appointed Members other than the chairman designated jointly by Secretary ins, Chairman Tracy, and the WLB. dustry and labor members appointed e new board are: Stephen D. Butts, oit, Mich., engineer and president e Detroit Building Employers Labor tions Council; and J. S. Miller, of burgh, senior vice president of the o Corporation, appointed to repre- respectively the general building tractors, and the general heavy con- tion and highway contractors; and N. Geary, Washington, D. C., tant general manager, National trical Contractors Assn., to repre- the sub-contractors.

rry C. Bates, president of the Inter- nal Union of Bricklayers, Masons, Plasterers' (AFL); Herbert Rivers, tary-treasurer, AFL Building Con- tion Trades Department, and Rob- yron, general president of the Sheet l Workers' International Assn. L), all of Washington, D. C., were inted to represent labor, as they on the old board.

ternate members are: Arthur D. Jr., assistant solicitor, Department of Labor, alternate for Mr. Tracy; and William Haber, assistant director of the program division of the War Manpower Commission, named alternate for Mr. Warren.

James D. Marshall, of Washington, D. C., assistant managing director of the Associated General Contractors of America, was appointed alternate for both Mr. Butts and Mr. Miller, two of the industry members. H. R. Cole, of Washington, D. C., executive secretary of the Tile and Mantel Contractors Association of America, was appointed Mr. Geary's alternate.

The labor alternates are: Michael Garrett, general organizer, United Association of Journeymen Plumbers and Steamfitters (AFL); John W. Garvey, general representative, International Hod Carriers, Building and Common Laborers' Union (AFL); and John McCurry, assistant to the international president, International Brotherhood of Electrical Workers (AFL).

Powers of the board

The WLB, in delegating its former authority over private building construction wages to the WAB, authorized the latter to "approve or disapprove, subject to appropriate review by the WLB, all applications for voluntary wage and salary adjustments, and to determine all labor disputes, in private building construction."

The board has power to act upon requests for wage adjustments when presented by local labor organizations with the approval of the international or national labor organization and submitted through and approved by the Building and Construction Trades Department of the American Federation of Labor, and it shall also consider and act upon requests for wage adjustments when presented by employers, government contracting agencies, of any group of workers not specified above.

The changeover, which was worked out by the WLB and the Department of Labor, was also approved by the Assistant Secretary of the Navy, the Under Secretary of War, and the chairman of the Maritime Commission; and the government agencies unanimously agreed to the retirement of representatives of the contracting agencies from WAB.

Stabilization desired

"The impracticability of applying the Little Steel formula to the building construction industry on an industry-wide basis is recognized," William H. Davis, chairman of the National War Labor Board, said in a recent letter to Secretary Perkins, and added: "We believe, however, that the same stabilizing effect must be achieved."

The order issued by WLB includes provision that employees are not automatically entitled to a Little Steel adjustment; persons getting higher rates of pay should receive a smaller percentage adjustment than those getting lower rates of pay; no adjustment shall be made in excess of the amount allowable under the Little Steel formula, even though the rate is below the highest rate formerly established in an area—a provision that is new to the board—and, where allowance of the full 15 percent allowable under the Little Steel formula would have an unstabilizing effect on wages in the industry or in the area, some or all of the 15 percent should be withheld. The latter limitation is to be invoked when the wage rates of those involved are relatively high in comparison with those of other employees in related work, or when the formula is applied to individual occupational groups in the highest wage brackets.

Mr. Davis also brought out in his letter to Secretary Perkins that because there are in the construction industry no wage brackets comparable to those in other industries, those provisions of wage adjustment are not applicable to the building construction industry.

The WAB can also approve adjustments "clearly necessary to correct substandards of living." Wage adjustments which would either increase price ceilings or, if no price ceilings are involved, would increase costs to the government, can become effective only if also approved by the director of Economic Stabilization.

Paterson, N. J., to buy 152-year-old company

The city of Paterson, N. J., has taken the first step to eliminate an unusual corporate anomaly, a private electrical power corporation with a 152-year-old charter granting it freedom from taxation in perpetuity.

Plans were announced for the city to purchase properties of the Society for Useful Manufactures, which was organized by Alexander Hamilton in 1791. The tax-exempt status of the society, believed to be the only company of its kind in the United States still enjoying that immunity, has been an irritant to the municipal and county tax authorities for more than 100 years, but the charter, issued by the state, has withstood all efforts to break it.

Under the contract recently signed, subject to approval by the Legislature and the Court of Chancery, the city will acquire electric plants and large holdings of real estate and equipment; and the society agreed to give up all rights to tax exemption and to dissolve within one year after the consummation of the sale.

Holdings to be turned over to the city include a hydro-electric plant, a steam electric plant, each capable of turning out 6,000 horsepower; eight factory buildings, nineteen parcels of unimproved real estate, a system of raceways originally designed to carry water power to mills remote from the falls, and various equipment, motor vehicles, pipelines and power lines. Also included are the company's valuable riparian rights to the Passaic River and its tributaries.

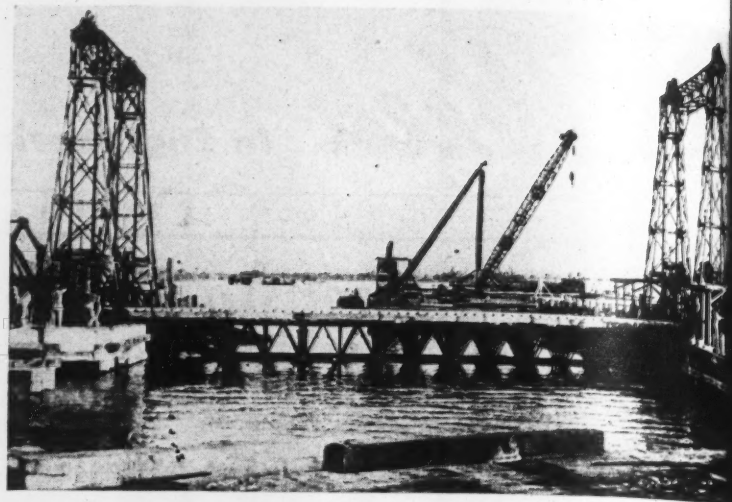
An article on this old company, written by M. N. Baker, appeared in *ENR*, Jan. 10, 1935, p. 45.

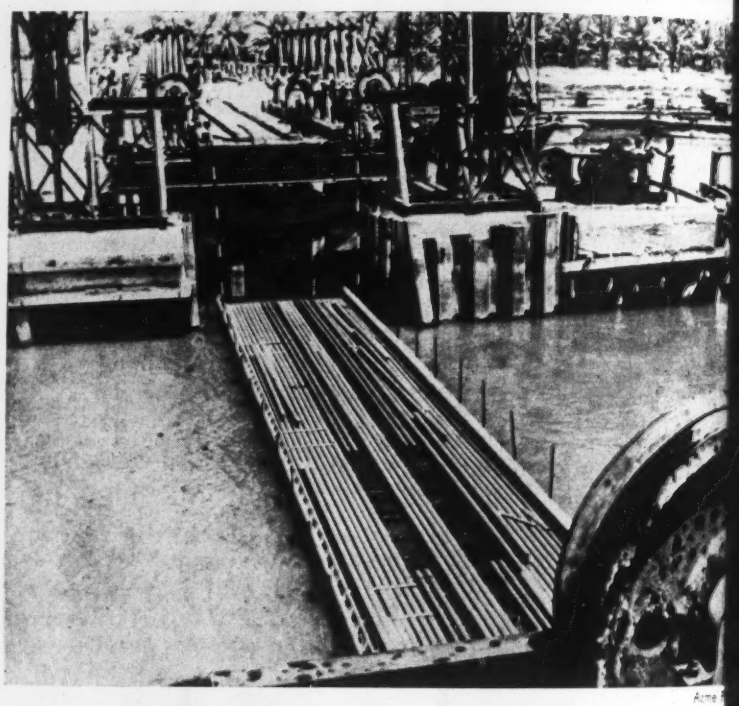
• • •

Engineers to study brine encroachment in oil field

The problem of salt water encroachment in oil fields, which results in some loss of underground oil, will be studied by the University of Texas engineers, supervised by F. B. Plummer of the University's Bureau of Economic Geology, assisted by H. H. Power, professor of petroleum engineering, Steve DeBord and Paul Tapp.

Encroachment of brine, as oil reserves diminish, is a problem in many fields, particularly in the great East Texas field. The East Texas Salt Water Company was organized and financed by operators there to pump the water back into abandoned wells after oil had been removed. Less than one-half the water is handled in this manner, however, and the rest of it is a source of contamination for streams in the area.





Acme

A lift span that goes down instead of up

Lowered beneath the water instead of being raised above it to permit ships to pass, the span pictured above represents a new concept of movable bridges. Located in Iraq in a crossing of the Shatt-al-Arab (River of the Arabs) which is formed by the confluence of the Tigris and Euphrates Rivers a few miles above the Persian Gulf, this bridge was mentioned in one of Waldo Bowman's Middle East articles (ENR Sept. 30, 1943, p. 500). These are the first pictures of the structure to arrive in this country. The job is one of the most interesting of the many carried out by the Royal Engineers.

The top view shows the span in up-position while in the bottom one it is on the verge of being submerged to its down position 20 ft. below the surface. The span is 92 ft. long and weighs 35 tons. Originally only short A-f towers had been planned, the counterwe to operate in sheetpile wells. These wells, ever, were not plumb and had to be a doned in favor of the overhead towers. In bottom view, note the men operating the hoist at the right; it is by means of such a at each of the four corners that the spa raised and lowered. This view also shows bridge seat beams on which the span res up position; they are slid back manually t it is desired to lower the span. In for position they span the recess in which the of the truss moves.

Accommodating both rail and road traffi its 15 ft. deck, the span is a product of Royal Engineers of the British Army. Brig C. Gifford Hull originated the idea.

roduction urgency committees created y WPB for labor shortage areas

ey will decide whether available construction labor is needed ore for expansion or repairs in specific instances.

ppointment of "production urgency mittees" in regions of acute labor tages is authorized in an order issued he War Production Board. Con- tion labor is included within the diction of these committees. The d's action has the immediate effect rmalizing action already taken in Pacific Coast cities—Seattle, Wash., land, Ore., San Francisco, Los An- , and San Diego, Calif.—to control of manpower, and also to authorize rol in additional areas as the need es. Already, three more cities—Hart- Conn., Detroit, Mich., and Akron, o—have been designated production ncy areas, and more are under con- ration for the designation.

hereas in the past the WPB con- red whether or not a certain project essential to the war effort, the pro- ion urgency committees will go fur- and decide whether the available r is needed more urgently for ex- sion or repair of a plant which has e application for construction work, whether it should be used to put up e homes to house workers already ged or needed by the plants now rating.

A WPB spokesman said that perhaps over-all construction will not be reduced, but added that there is need for a "terrific amount of shifting of labor from construction jobs which, though they may be essential to the war, are less essential in a given region than some other type of construction."

To help manpower situation

Where construction would provide facilities which, no matter how greatly needed, would only increase the demand for more labor to operate them, those facilities will be voted down, possibly in favor of other construction which would aid rather than complicate the situation.

The committee chairmen are to be WPB men, appointed by the WPB regional directors. Assistants will include persons competent to advise on problems affecting the manpower situation. Other members of the committees are to represent the War Manpower Commission, the Army, Navy, Maritime Commission, Army Air Forces, and the War Food Administration. Representatives from other agencies will be called in when the committees are dealing with the specific problems of such other agencies.

Stress grade lumber specifications ready

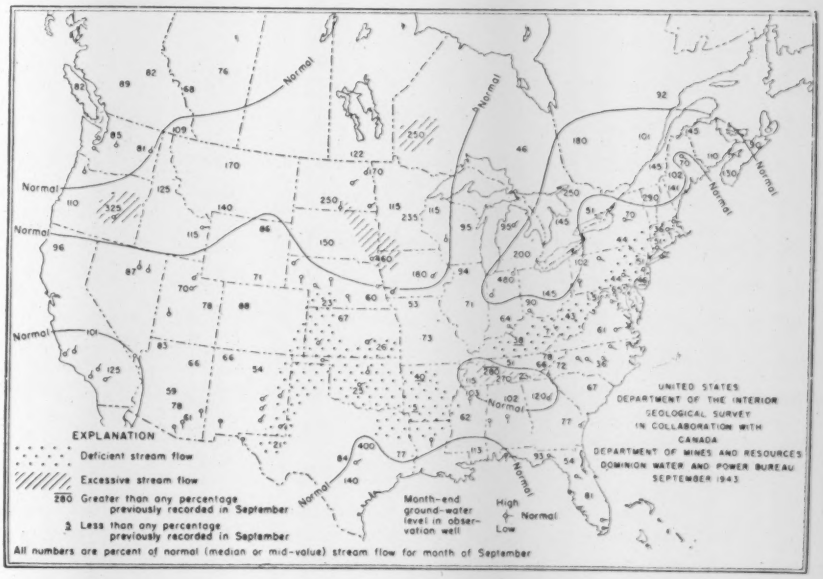
Official data is now available on the means and requirements for putting into effect the 20 percent increase in working stresses for lumber authorized by the Conservation Division of the War Production Board (*ENR*, Aug. 19, 1943, p. 295). Published under the title "National Emergency Specifications for the Design, Fabrication and Erection of Stress Grade Lumber and its Fastenings for Buildings" it may be procured for 15 cents from the War Production Board Room 1090, Railroad Retirement Building, Washington (25) D. C.

This pamphlet is much more than specifications, it is a usable design manual for lumber and fastenings. It covers not only working stresses for structural grades of lumber and design loads and formulas but timber connector, bolt, lag screw, nail, drift pin, wood screw and glued construction as well. The 64-page, magazine-size pamphlet is of value to all designers and users of lumber, far beyond the price quoted by the government printing office.

Irrigation season is closing with surplus water storage

September stream flow was above nal in 40 percent of the United States Canada; subnormal in 60 percent. 0 percent of the area the subnormal m flow reached drought intensity. re were only four small areas of ex- ive stream flow. In most of the north- regions the above-normal flow repre- ed the drainage of natural storage ch was relatively high at the begin- of the month. By and large, stream continued near or above normal in major power-producing areas, except e middle and south Atlantic regions. the West and Canada the irrigation on is closing with surplus storage. rface-water supplies improved in thern New Mexico, southeastern as, southern Louisiana, Mississippi, North Carolina, Tennessee, and Vir- a. The improvement in Mississippi pecially noteworthy. Drought or semi- ught continued in Massachusetts, necticut, New York, New Jersey, nsylvania, Maryland, West Virginia, ginia, Kentucky, Mississippi, Louisi- Arkansas, Oklahoma, parts of Kan- and eastern New Mexico.

rom the viewpoint of meeting indus- trial and municipal water demands above-normal precipitation is urgently needed along the Atlantic Coast, upper Ohio Valley, in the Gulf States, the southern plains, and in the Southwest. Elsewhere the water outlook for the immediate future is dominantly favorable.


Normal
EXPLANATION
Deficient stream flow
Excessive stream flow
280 Greater than any percentage previously recorded in September
2 Less than any percentage previously recorded in September
Month-end ground-water level in observation well
High
Normal
Low
All numbers are percent of normal (median or mid-value) stream flow for month of September
UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY IN COLLABORATION WITH CANADA DEPARTMENT OF MINES AND RESOURCES DOMINION WATER AND POWER BUREAU SEPTEMBER 1943

Letter from LATIN AMERICA

By Edward J. Cleary
Managing Editor, Engineering News-Record

This is the fourth field letter received from Mr. Cleary, who has just returned from a 16,000-mile trip. He reports that five more letters were mailed en-route, but thus far these have not reached New York—The Editors.

Rio De Janeiro, Aug. 25, 1943—

Several years ago I read or heard about a vast drainage project in South America, the size of which dwarfed the much heralded Pontine Marsh drainage scheme in Italy. I could not recall the location, however, and inquiries throughout my travels thus far elicited no helpful information.

It came as a complete surprise, therefore, when I visited the National Department of Sanitation Works in Rio, to discover that instead of building sanitation facilities in the sense that we think of them this department was the agency concerned with land reclamation by drainage. And the principal project on which they are working is the drainage of a great marsh land that extends up and down the coast from Rio.

The project, covering an area of 7,000 square miles, is more than thirty times the size of the Pontine marshes. Begun in 1938, the Brazilian project includes the ditching and diking of the marshes, and the installation of lowhead pumping stations and tidal gates. The reclaimed land, freed from standing water and malaria-mosquito breeding, is sold in small parcels and at low rates to trucks gardeners. Thus the government is encouraging production of farm produce close to population centers, and is making it possible for farmers to purchase land on an easy payment plan from the profits they receive on sales.

Dr. Luiz Pinto, civil engineer and administrative chief of the department, who showed me some of the drainage structures also gave me the assurance that I need search no further for the world's largest drainage operations—we were looking at them, he said, with not a little pride.

Touring Brazil with Baity

Dr. H. G. Baity, chief engineer of the Health and Sanitation Mission of the Institute of Inter-American Affairs in Brazil (now on leave from his post of professor of sanitary engineering at the University of North Carolina) is virtually giving me a personally-conducted tour of highlight engineering activities in this great country. To make certain that I would get proper perspective on water supply and sewage treatment activities, he turned me over to Dr. F. Saturnino Brito, Jr., one of the country's outstanding sanitary engineers, and the son of Brazil's most distinguished sanitarian. Dr. Brito's father, who died a few years ago, built some of the earliest water supply and sewage disposal facilities in South America; father and son, together, have been consultants on projects for 53 municipalities in Brazil, including the famous "drifting sand" filters at Recife.

Dr. Brito apparently dropped all of his activities to give me undivided attention for three days. Despite the extreme shortage of gasoline, (most of the automobiles here are equipped with "gasogenios"—a charcoal gas-generating device that is said to be expensive and unreliable) he always appeared with a gasoline-operated car.

Like many Brazilian engineers, Dr. Brito's interests extend far beyond his own field of specialization. Thus it was that his arrangements included visits to building construction projects, housing developments, malaria-control operations and to a mountain resort city now under construction called Quitandinha.

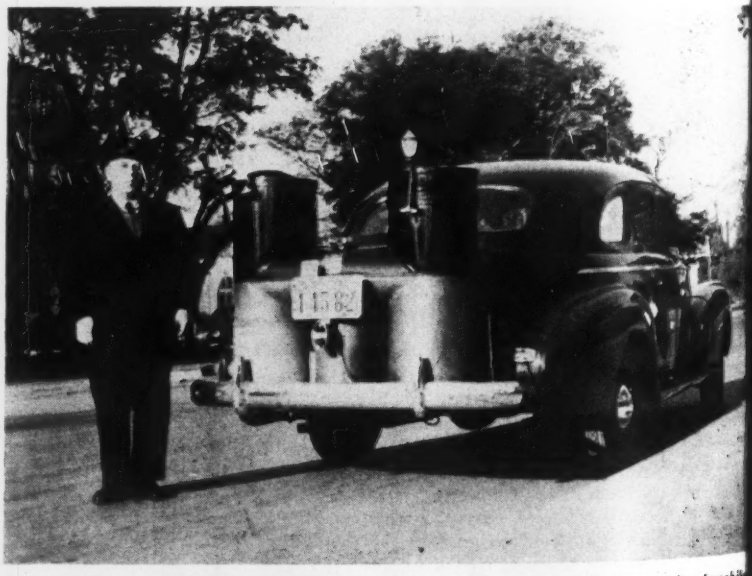
Focal point of interest at this [re]place is the hotel, which has [al]reached completion. Colossal is the [w]for it—regardless of whether you are [a] engineer, an architect, a social butte[r] or just a naive New Yorker. Built [e]tirely of reinforced concrete (20[,] cu.yd.) and of modified Swiss chalet [de]sign, it includes a theatre that is big[ger] than the Opera House in Rio, and [its] social rooms alone will accommod[ate] 10,000 people at one time.

Most spectacular, perhaps, from [the] structural engineer's viewpoint, is [the] casino room. This is circular, with [a] diameter of 164 ft. and the roof is [a] thin concrete dome with a thickness [of] only 4 in. From the floor to the top [of] the dome the height is 92 ft. Other [de]sign features include huge concre[te] trusses from which the ceilings are hu[ng] in both the theatre and grill room ([the] latter seats 1,000 people and is equipp[ed] with a 92 ft. diameter revolving st[age] and a 20 ft. diameter disappearing [or]chestra pit.

Brazilian quick-lunch

With food rationing what it is tod[ay] in the States, it may be a bit unfair t[o] report that I seldom have less than t[wo] 7-course meals a day. Brazilians ar[e] great eaters, and when in Brazil [one] must do as the Brazilians do.

The importance of food was empha[-]sized when we stopped at the constru[c]tion camp in Quitandinha. Although [our] host did not expect us for lunch, arrivin[g] as we did late in the afternoon, he "di[s]covered" that we were hungry after [our] early morning start. In less time than [it] takes to tell it he ushered us into th[e] camp dining quarters, and this is wh[ere]



With gasoline virtually unobtainable in Brazil, the "gasogenio"-equipped automobile is a common sight. This gas-generating device, which employs charcoal for fuel, is cumbersome, expensive and temperamental.

Bogged down in the mud on a Brazilian airfield, Correspondent Cleary surveys the situation philosophically.

we had: Vermouth cocktails, rolls, potato salad, scrambled eggs and rice, fried chicken and peas, steak and beans, beer, cheese, peaches and, of course, the inevitable cup of strong, black coffee. All the while these various courses were being served our host kept apologizing because he was not prepared to treat us properly!

Remember, please, that this banquet was a Brazilian contractor's conception of a "quick" lunch. Then draw your own conclusions as to what I have to face twice a day in hotels and restaurants. Home was never like this!

• • •

John B. Jackson awarded Octave Chanute medal

John B. Jackson, Commonwealth Edison Company engineer of Chicago, will be given the Octave Chanute medal for 1943 by the Western Society of Engineers. This medal is awarded annually to Chicago engineers for the best paper on civil engineering, electrical or mechanical subjects presented before the society.

Mr. Jackson's prize-winning paper, "Relocation of Utility Substructures—Chicago Subway," described the removal of the maze of electric power and communication cables, gas and water mains buried under Chicago's streets to make room for the recently completed subway. The Chanute Award was founded in 1901 by the late Octave Chanute during his term as president of the society.

Sanitation problems in foreign fields win attention at A. P. H. A. meeting

Public health engineers hear of experience with mosquito and water-borne diseases in Army theatres-of-operation, as well as Latin-American sanitation activities.

Stating that malaria and dysentery together constituted 50 percent of all causes for hospitalization in battle areas, Col. W. A. Hardenbergh, chief engineer of the Sanitary Corps, told the American Public Health Association last week of the sanitation problems that must be faced in maintaining the effectiveness of the fighting forces.

Field control of mosquito and water-borne diseases, he pointed out, is a job that involves the cooperation of every man in the army, and is not simply the responsibility of sanitary or medical officers. Malaria is so prevalent that every company now includes a squad of men selected to enforce "sanitary discipline" measures, which include, among other things, use of sleeping nets, mosquito repellents and protective clothing.

Although the engineering personnel of the Sanitary Corps is now 6½ times greater than it was in World War I, few of the men have had previous experience in dealing with situations under tropical conditions, and this has necessitated special training.

Dysentery infections, which are second only to malaria, have led to a study and development of field treatment methods of water for the control of amoebic dysentery and schistosomiasis, reported Col. Hardenbergh.

Latin American health work

The work of the sanitary engineer in providing healthful environmental conditions in Latin America has increased greatly, reported Maj. Harold B. Gotaas, assistant director of the health and sanitation division of the office of the Coordinator of Inter-American Affairs.

Maj. Gotaas pointed out that hemispheric cooperation in public health has centered around the Rockefeller Foundation, the Pan-American Sanitary Bureau, and lately the office of the Coordinator of Inter-American Affairs.

Safe water supplies, he said, are lacking in many of the smaller cities and towns of Latin America, and one of the first efforts of public health organizations must be toward an improvement of water quality. The greatest health problem in the area is the control of mosquito-borne diseases. Malaria, yellow fever, dengue and filariasis are constant menaces, even though locally under control.

Newly elected officers of the engineering section of the A.P.H.A. for the coming year are: Chairman, Sol Pincus, assistant commissioner, Department of Health, New York City; vice chairman, Alfred Fletcher, The Johns-Hopkins School of Public Health; and secretary, John M. Hepler, director of the Bureau of Engineering, Lansing, Mich.

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Reclamation conference at Denver next week

All regional reclamation directors and the entire executive personnel of the U. S. Bureau of Reclamation have been directed by Commissioner Harry W. Bashore to go to Denver, Colo., to meet with farm representatives from 17 western states on Oct. 27, 28 and 29.

The Denver conference on irrigation and war food problems follows a meeting in Washington, D. C., two weeks ago, at which reclamation bureau personnel worked over the agency's new reorganization program.

Commissioner Bashore and his regional lieutenants will confer with representatives from California, Oregon, Washington, Idaho, Montana, North and South Dakota, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Arizona, Nevada, Utah, Wyoming and Colorado in attendance at the 12th annual meeting of the National Reclamation Association.

The keynote of the meeting will be immediate conversion of arid lands to irrigated production of food vitally needed now for the war and later for postwar distribution among the starving millions in the occupied countries.

F. O. Hagie, secretary-manager of the association, said: "Food now is considered a weapon. The cooperation of millions of persons in the occupied countries is being assured by Anglo-American promises to provide them with food until they are able to provide their own. To back up those promises, we have to increase our food production. Expansion of irrigation agriculture offers the surest and best method for doing that."

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Akron's sewer system to undergo improvement

Akron, Ohio, has retained Havens and Emerson, consulting engineers, of Cleveland, to review the city's present sewage disposal plans and to develop a project for the enlargement and improvement of the system.

JOBS OF THE WEEK

BUILDINGS, Nebraska
C. C. Larsen & Sons, Council Bluffs, Ia., have been awarded contract for buildings, Dawes County, by U. S. Engineers, Omaha, Neb. Cost under $5,000,000.

HOUSING, Utah
Defense Plant Corp., Washington, D. C., awarded a contract for housing at industrial plant to W. E. Ryberg, Strong & Grant, Salt Lake City, at an estimated cost of $2,000,000. Arthur C. Holden, New York, N. Y., is the architect.

MAGAZINES, etc., New Jersey
Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded a contract for storehouses, railroads, services at Naval Air Depot to Cauldwell Wingate Co., Asbury Park, N. J., at $9,157,917.

SCHOOL, Sampson, N. Y.
Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded a contract for a school group at Naval Training Station, to Woodcrest Construction Co., and Rosoff Brothers, New York, N. Y., at $1,777,990.

MANUFACTURING PLANT, Indiana
Henry Ericsson Co., Chicago, Ill., has been awarded a contract to construct manufacturing plant additions and rehabilitating existing buildings by Phelps-Dodge Corp., New York, N. Y. The cost will be $13,000,000 with equipment. Defense Plant Corp. will finance. Wilbur Jurden, New York, N. Y., and company engineers will be engineers and architects.

DWELLINGS, Van Nuys, Calif.
Thoreson Construction Co., Los Angeles, Calif., will build 240 frame and plaster dwellings for Lorraine M. Yates. The estimated cost is $1,900,000.

HOUSING, California
L. F. Dow Co., Los Angeles, Calif., has been awarded a contract for housing and community building, by Public Housing Authority, San Francisco. The estimated cost is $1,000,000. W. P. Day and Associates, San Francisco, are the architects.

IMPROVEMENTS, Alaska
Morrison-Knudsen Co., Boise, Ida., has been awarded a contract by U. S. Engineers, Seattle, Wash., for improvements. The estimated cost is $3,000,000.

PLANT, Jamestown, N. Y.
American Aviation Corp., New York, N. Y., awarded a contract for aircraft factory addition, to A. Friederich & Sons Co., Rochester, N. Y., to cost $1,186,000. Defense Plant Corp. will finance. Beck & Tinkham, Jamestown, N. Y., architects.

ENLARGING DAM and PAVING, South Carolina
South Carolina Electric & Gas Co., Columbia, awarded a contract for enlarging the spillway of the Saluda Dam to three times its present capacity, for enlarging fill on downstream slope and for paving highway across the dam, to A. I. Savin Construction Co., Hartford, Conn., and Columbia, S. C. Cost will exceed $1,000,000. Clarence Sharp will be general superintendent for the project, and Lloyd McCarthy is in charge of excavation and road work.

RAILROAD, New Jersey
Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded a contract to build a railroad at Naval Ammunition Depot, Earl, N. J., to G. M. Brewster & Son, Inc., Washington, D. C., at $2,370,000.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 74.

Illinois engineering act to be tested in court

A suit to enjoin the State of Illinois from enforcing the recently enacted Professional Engineering Registration Act has been filed in the circuit court of Sangamon County by a screen manufacturer acting as a taxpayer, but the identity of others behind the suit has not been disclosed. The state attorney general has notified the Illinois Engineering Council that he will defend the suit and has appointed former judge W. F. Gray to conduct the defense. The council has engaged George E. Drach as its attorney, but as the suit is not against the organized professional engineers he can act only as "friend of the court."

According to a statement issued by the Illinois Society of Engineers, the case is likely to drag through the courts for some time, reaching the state supreme court for final decision. The council states that "although no injunction had been granted up to Aug. 1, when the law went into effect, it is probable that, pending the outcome of the suit, no action will be taken towards the law's enforcement, and no engineer will be able to secure registration under the law."

Labor opposes regulation act of Texas legislature

The Manford Labor Regulation Act passed by the last session of the Texas Legislature has aroused a storm of protest from organized labor.

The act requires labor union organizers and officials to register with the Secretary of State, prohibits their solicitation of union members without a state permit, requires the filing of annual financial statements, forbids unions charging for work permits, makes it mandatory for union organizers, officials and agents to be Texas citizens if their organizations operates in Texas only, prohibits unions from charging fees in excess of amounts needed to meet reasonable union expenses, and requires unions to file working agreements in cases involving check-off of dues.

Widespread interest

Long before the act became effective on August 10, labor began its fight against it, national, state and local American Federation of Labor unions, including the United Brotherhood of Carpenters and Joiners of America, of Austin, and the International Brotherhood of Boilermakers, Iron Shipbuilders and Helpers, of Houston, filed suit to enjoin enforcement of the law as unconstitutional. The unions' petition also claimed that the Manford Act conflicts with the National Labor Relations Act, takes rights from unions without due process of law, and is an unreasonable effort to police the state and interfere with freedom of contract. The court was asked to declare the statute void.

The Manford Act became law, however, before the unions' suit was heard in court. Hearings will begin soon and the A. F. of L. unions have been joined in the suit by the C.I.O.

Court test desired

To make certain of a court test of the validity of the Act, R. J. Thomas, president of the United Automobile Workers and a C.I.O. vice president, addressed a mass meeting of oil workers near Houston and solicited union memberships without a permit. This violated the Manford Act, as Mr. Thomas intended it to, and also violated a temporary injunction against soliciting union memberships without an organizer's card, issued against Thomas on Sept. 22, by Texas District Judge J. Harris Gardner.

After his speech, Thomas was arrested. He was released later on bail but must return to Texas to face the Austin court for contempt of court in violating its injunction against him for soliciting union membership without a license, and to face a court at Houston on charges of violating the Texas "union organizers' license law." Repercussions to this Texas dispute are expected elsewhere.

OBITUARY

win D. Haseltine, 85, who knew the e of most coal mines in the Youngs- district through 25 years of under- nd surveying, and who worked there ears as an engineer, died in that city 4. For the past year he had been e as a consulting engineer for the

M. Garthwait, 81, retired contrac- of Charlotte, N. C., died Oct. 5. He at one time with the North-Eastern truction Co., of Winston-Salem, C. He spent the major portion of his in the contracting business.

ohn H. Hilton, 88, pioneer in steel way bridge building, died Oct. 2 at home in Bowerston, Ohio. He was engineer for the former Wrought Bridge Co. of Canton. While serv- as construction engineer for the enix Bridge Co. he was in charge of ding the old suspension bridge across Ohio river at East Liverpool.

William H. Armstrong, 65, of Racine, chairman of the Wisconsin State hway Commission, died Oct. 5.

. D. Tiner, for seventeen years chief neer of the Texas Public Utilities at Colorado City, Tex., died there 1.

dwin C. Hurd, 41, sanitation engi- of Indianapolis, Ind., died Oct. 3. Hurd was associated with his father, rles H. Hurd, as consulting engineer. was known as an expert on water sup- and sewage treatment engineering. and his father designed the Indian- s sanitation plant and more than 50 similar plants in the Middle West.

Henry A. Wright, 96, of Liverpool, S., died Sept. 16. For 65 years he had a general contractor.

Frank B. Standiford, 57, a civil engi- with E. B. Badger & Sons, New k, died Oct. 14. Mr. Standiford was duated from Purdue University in 4. He served the Alaskan Railroad as connaissance engineer, was a lieuten- commander in the Navy during the t World War and had been an execu- of the Pennsylvania Power and Light mpany in Allentown.

Hugh McLeod, 70, Raleigh, N. C., mber of the engineering department he North Carolina State Highway and blic Works Commission for past 22 rs, died at Fayetteville, N. C., Oct. 12. began his engineering career in min- work.

Lorenze Brunotto, died in Montreal, Que., on Oct. 10. He was in charge of the Library of the Ecole Polytechnique and under his direction it was developed into one of the most complete reference libraries in Canada. Engineering books from the United States, England and France as well as engineering revues from all over the world were collected and placed at the disposition of all engineers.

Geoffrey Stead, 71, of St. John, N.B., died there Oct. 10. Born in Brooklyn, N. Y., he was the first graduate of an engineering school established at the University of New Brunswick. He was in engineering work of various kinds in Canada and the United States until he joined the engineering staff of the Canadian department of public works. He retired in 1939 after having served 39 years as a public works engineer.

Topographic maps made quickly from air photos

Large strategic areas of the United States, never before comprehensively plotted, are now being photographed from the air and topographically mapped at speeds of three to five times greater than were possible before the war, it was revealed September 25 by the Department of the Interior.

In a report to Secretary Ickes, William Embry Wrather, director of the Geological Survey for the department, disclosed that the complicated process of mapping the country's distances and contours was not only vital to the conduct of military operations, but that the results of the operations would have a large part in the planning and execution of flood control, river and harbor improvement, and power and irrigation enterprises.

CONTRACTS AND CAPITAL

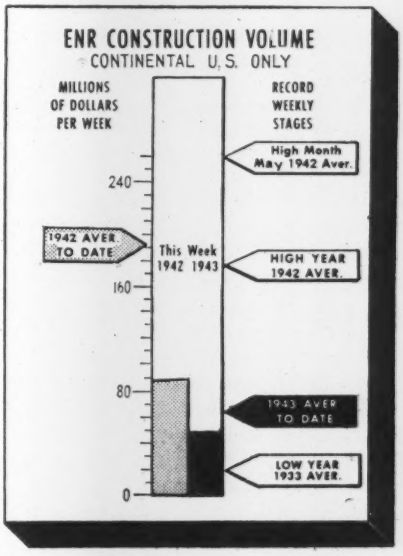
CIVIL ENGINEERING construction volume in continental U. S. totals $50,755,000 for the week. This volume, not including construction by military engineers abroad, American contracts outside the country, and shipbuilding, is 30 percent lower than a week ago, and is 42 percent below the total for the corresponding 1942 week.

Private construction is 76 percent lower than last week, but climbs 66 percent above last year. Public work tops a week ago by 1 percent as a result of the 5 percent gain in federal volume, but is 48 percent below a year ago.

The current week's construction brings 1943 volume to $2,649,767,000, an average of $63,090,000 for each of the 42 weeks. On the weekly average basis, 1943 volume is 67 percent below the $8,221,303,000 for the 43-week period in 1942. Private construction, $372,476,000, is 24 percent lower than a year ago, and public construction, $2,277,291,000, is down 70 percent when adjusted for the difference in the number of weeks.

In the classified construction groups, gains over last week are in public buildings, and streets and roads. Commercial building is the only class to gain over the 1942 week.

New capital for construction purposes for the week totals $1,028,000, and is made up entirely of state and municipal bond sales. New construction financing for the 42 weeks of 1943, $3,042,594,000, is 67 percent below the $9,554,598,000 reported for the 43-week 1942 period.



CONTRACTS

Continental U. S. Only
(Thousands of dollars)

	Week Ending Oct. 22 1942	Oct. 14 1943	Oct. 21 1943
Federal	$80,235	$38,203	$40,216
State & Municipal	3,335	4,539	3,206
Total public	$83,570	$42,742	$43,422
Total private	4,425	30,113	7,333
TOTAL	$87,995	$72,855	$50,755
Cumulative 1943 (42 weeks)			$2,649,767
1942 (43 weeks)			$8,221,303

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1942 43 weeks	1943 42 weeks
NON-FEDERAL	$587,700	$288,756
Corp. Securities	169,889	18,228
State & Mun	204,656	104,850
R.F.C. loans	130,455	14,545
FPHA loans	.....	3,133
R.E.A. loans	.....	20,000
Fed.-Aid Hwy	82,700	128,000
FEDERAL	$8,966,898	$2,753,838
TOTAL CAPITAL	$9,554,598	$3,042,594

ENR INDEX NUMBERS

Index Base=100		1913	1926
Construction Cost	Oct. '43	294.31	141.47
Building Cost	Oct. '43	231.29	125.03
Volume	Sept. '43	155	68

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Strength of Anchors

Sir: The article in *Engineering News-Record*, April 22, 1943, p. 560 by Harry E. Graham and entitled "Strength of Steel Anchors in Concrete" is very interesting. As this test was so carefully prepared, it indicates the possibilities of anchoring directly in the concrete without the use of expansion anchors.

Possibly my viewpoint is biased as a manufacturer of expansion anchors, but my experience has proved that better results may be obtained with less difficulties and expenditure of labor than by grouting in the bars or even pre-setting in the concrete before it is poured. Most difficulties encountered by engineers in the use of expansion anchors are due to the use of a type that is improperly designed or lack of efficiency in the installation. In either case this may be due to lack of knowledge or experience on the part of the user.

The figures given by Mr. Graham seem very high for this method of anchoring, and I have not made experiments with bolts of this size in any comparison of resistance to withdrawal that are actually installed with expansion anchors. However, I have made many tests with screws and bolts from $\frac{3}{16}$ to 1-in. diameter, in installations of various depths in concrete. An ordinary $\frac{5}{8}$-in. bolt anchored in the concrete for a depth of 3 in. should withstand a pull of 12,000 lb.

My experience has shown that bolts grouted into a hole, particularly in horizontal installations require a great deal of time and care to insure proper filling of the space between the bolt and the masonry. Grout does not adhere very well to old concrete surfaces. Considerable time must be allowed before any load or strain can be applied to the grouted-in bolt.

Caulked lead wool must be thoroughly compressed or tamped in very carefully in small quantities to insure full expansion. Lead alone when used as an anchorage is subject to creep or stretch under strain. To be effective the lead must be properly interspersed with a harder metal to act as a reinforcement and overcome this creepage.

The depth of anchoring in the masonry must depend on the strength of the concrete. This should be sufficient to overcome the tendency to surface fractures when overloaded, that is, the concrete may fail before the bolt or expansion anchor has a chance to develop full strength. Anything beyond this depth is superfluous, requires more time for the installation and does not increase strength of the anchorage itself.

A straight-out pull on a bolt anchored in masonry is an easier strain than any load in sheer. In fact vibration even under a slight strain is more destructive to holding power or resistance against withdrawal than any other effect on masonry anchors.

A suitable expansion bolt insures uniformity in installation, eliminates the human error that may vary with each application. It is not possible to standardize on a grouted-in bolt without allowing a wide margin of safety. Besides there is nothing gained except the cost of an anchor and that may be offset many times by labor charges.

A. W. GELPCKE
The Rawlplug Co., Inc.,
98 Lafayette St.
New York, N. Y.

Double Reinforced Concrete Beams

Sir: When I read J. F. P. Tate's article on "Simplified Equations for Concrete Beams" (*ENR* Sept. 9, 1943, p. 388), I wondered if he had read my discussion (*ENR* May 6, 1943, p. 662) of a similar article (*ENR* March 11, p. 365) by Odd Albert.

Mr. Tate has derived formulas which he states will be helpful in saving time and material in structural design. The writer desires to explore the accuracy of this statement.

Any application of Mr. Tate's formula (5) which locates the neutral plane 5.56 in. below the top of the beam can be made only *after* the cross-sectional dimensions of the beam and areas of steel have, by some means or other, been determined. The use of compressive steel indicates that neither the breadth nor depth of the beam may be increased. Economic reasons theoretically forbid the use of compressive steel except when these dimensions are circumscribed.

The permissible unit stress of 855 psi. for a 3,000 psi. concrete is too low if the inspector is honest and capable. If the inspector got his job solely because he is a cousin of a man who sits in high political places, the odds are even that 855 psi. is too high. In either case 23,600 psi. is straining the point (and the steel) considerably.

Assuming that the dimensions of the beam may not be increased and that the unit stress in concrete is held at 855 psi., let us see if a more economical design is possible.

We are, of course, at liberty to move the neutral plane to any desired position, so long as the areas of tensile and compressive steel are adjusted so that the total tension on a cross section balances the total compression. Therefore, let's see what happens when the neutral plane is arbitrarily moved from 5.56 in. to 6.75 in. from the top of the beam.

$\frac{855 \times 10}{6.75} = 1{,}267$ = unit stress in steel when one inch from neutral plane

$1{,}267 \times 4.75 = 6{,}018$ = unit stress in compressive steel

$1{,}267 \times 14.25 = 18{,}050$ = unit stress in tensile steel

$\frac{855}{2} \times 6.75 \times 14 = 14{,}400$ = compressive stress in concrete

Balance moments about the tensile steel

$40{,}400 \times 18.75 = 757{,}500$ in.-lb. = resisting moment in concrete

$900{,}000 - 757{,}500 = 142{,}500$ in.-lb. resisting moment which must be carried by compressive steel.

$142{,}500 \div 19 = 7{,}500$ lb. = compressive stress in steel

$7{,}500 \div 6{,}018 = 1.25$ sq. in. required area of compressive steel

$40{,}000 - 7{,}500 = 47{,}900$ lb. = stress in tensile steel

$\frac{47{,}900}{18{,}050} = 2.65$ sq. in. required area of tensile steel

Total area of steel is $1.25 + 2.65$

= 3.9 sq. in. when the unit stress in tensile steel is only 18,050 psi.

Mr. Tate's solution requires a total of 4.53 sq. in. of steel when the unit stress in the steel is 23,600 psi.

By comparing the two solutions we find the lower unit stress in steel accompanied by a lesser *total* steel area required.

This rational conclusion is not a paradox. For further comment on this conclusion see the writer's discussion previously mentioned.

It might also be pointed out that in the above case the location of the neutral plane which will require the least amount of steel (3.71 sq. in.) is 7.96 in. from the top, a location that may be determined by use of the calculus or merely by making a few trial locations of the neutral plane.

CHARLES A. ELLIS
Prof. of Structural Engineering, Purdue University, Lafayette, Indiana

Sewage Plant Costs

Sir: We have just read with much interest the article entitled "Low Cost Sewage Treatment Facilities for a War Plant" (*ENR*, Aug. 26, 1943, p. 350) and the editorial comment as well (p. 318). We are of course pleased that the design and construction resulted in favorable costs and that the *News-Record* has given such favorable recognition of this inasmuch as the detailed plans were prepared by us for E. B. Badger & Sons Co.

While we tried conscientiously to keep the cost of the sewage treatment plant at the West Virginia Ordnance Works as low as possible considering the temporary character of the installation, you might be interested in knowing that the cost is not out of line with a number of other small sewage treatment installations for which we have prepared plans and specifications and supervised construction. We have looked up our records and have listed on the accompanying tabulation eight relatively small sewage treatment plants, with per capita cost, resulting in an average of $8.58.

These plants are located in various parts of the country and cover the period from 1929 to 1941. The list includes the treatment plant at Camp Forrest for 28,500 troops. This plant includes high-rate trickling filters as well as plain sedimentation. Our records indicate that this treatment plant costs $7.95 per capita. All the other plants listed comprise plain sedimentation only and are therefore more comparable to the plant at the West Virginia Ordnance Works.

Your article indicates a per capita cost of $9.50 for the plant at the West Virginia Ordnance Works. Probably 500 people should be added to the population given in the article, as capacity was included for a proposed housing development. On this basis the per capita cost would be $8.55 instead of $9.50.

PER CAPITA COSTS OF SMALL SEWAGE TREATMENT PLANTS DESIGNED BY GREELEY AND HANSEN OF CHICAGO

Project	Pop.	Yr. Built	Price Index	Cost Per Capita When Built	Cost Per Capita Adjusted to 1942
Bardstown	2,600	1929	210	$8.30	$11.10
Harrodsburg	4,800	1929	210	7.70	10.30
South Haven	5,000	1933	200	6.40	9.00
Winona	30,000	1933	200	4.20	5.90
Charlevoix	8,000	1934	195	6.00	8.60
Washington Court House	12,000	1935	205	5.50	7.50
Rhinelander	13,500	1939	235	6.30	7.50
Camp Forrest	28,500	1941	255	7.95	8.75
Average	.....	.....	.....	.....	$8.58
West Virginia	4,500	1942	280	.....	$9.50
West Virginia	.....	1942	280	.....	$8.55

PAUL HANSEN,
Greeley and Hansen, Engineers Chicago, Ill.

History of Sutro Weirs

Sir: The article by Edward Gerald Smith in *ENR* July 29, p. 198, is very interesting and opens up large possibilities in the easy construction of a proportional weir. The method of separating the $\sqrt{H}$ and H in order to obtain the proportional equation is somewhat novel. It also would be easy to combine 1.57 and C as one constant, particularly since the result is near unity.

In order to indicate that the whole theory is not new, reference is made to a casual description of Sutro weirs in the 1912 *Proceedings* of the American Water Works Association, p. 212. These weirs were first used by Harry H. Sutro in 1908. The original Sutro weir had one *vertical* side and one curved side. Probably Prof. E. W. Rettger was the first to devise a symmetrical proportional flow weir and it was described in *Engineering News*, June 25, 1914. E. A. Pratt developed the theory of the Sutro weir in *Engineering News* Aug. 27, 1914, p. 462. Howard Livingston worked on a thesis on Sutro weirs in 1915 (see *Engineering News*, Aug. 5, 1915 —letter by Ben D. Moses) and the writer has a reference to another article by Prof. Rettger on p. 1,018 of *Engineering News* on Nov. 25, 1915. Still another reference appeared in *Engineering News* of 1915, but details are not at hand.

Clemens Herschel is believed to have described a proportional flow weir in *Engineering News-Record* between 1918 and 1920.

Various references to proportional weirs have appeared at odd intervals since then. Rights to the manufacture of Sutro weirs were controlled first by the patents owned by L. M. Booth Co.—later sold to the Refinite Co. The writer received a blueprint of such weirs made by the latter company in September 1921.

There is little available at the moment to indicate just when someone conceived the idea of converting the Sutro weir into a symmetrical form similar to the Rettger type. It may be that the advantages of both types were recognized and combined. Unless better proof is offered, the writer is inclined to believe that the symmetrical weir might be more properly termed the Rettger-Sutro weir.

The writer has seen such weirs used for controlling flow in grit chambers as far back as 1926.

CHARLES H. CAPEN
Chief Engineer New Jersey District Water Supply Commission Wanaque, N. J.

New Word Needed

Sir: With reference to your editorial, July 29, p. 188, on "New Word Needed" to describe work done in shops on timber structures: I would like to offer the word "Fabricutting."

L. A. SCHMIDT, JR.
Lookout Mountain, Tenn.

EDITORIALS

VOLUME 131 NUMBER 17

October 21, 1943

Design for Fire Safety

FIRE LOSS IN THE UNITED STATES since Pearl Harbor is said to be comparable to all the damage caused by enemy bombing in England during the first two years of the war. In terms of money the loss amounted to $315,000,000 in 1942 and may total $400,000,000 in 1943. This is at once an indictment and a challenge to designers and builders. War construction necessarily has been largely temporary and much of it not fireproof. Designs for postwar, both architectural and structural, must be made to meet this challenge to life and this material loss. And currently, to reduce fire damage, every engineer concerned with maintenance should inspect sprinklers, heating equipment and careless storage of goods, especially waste material.

A Lesson from the Normandie

NOW THAT THE SUNKEN LINER "Normandie" has been righted (*ENR* Aug. 12, 1943, p. 264), it seems pertinent to point out that the operation should never have been necessary. For 18 months the great vessel rested ignominiously on the muddy bottom of the Hudson, and for 9 months or a year more will not be in position to serve the Allied cause; and all because of carelessness, divided responsibility and lack of advance planning on what to do in an emergency. The lesson of the "Normandie" can well be applied to our planning for living and working in a postwar world. We must have a course of action ready, authority must be definite and adequate and, above all, plans for actual work must be ready for men and machines to do something useful. Otherwise much that has been fought for will be lost.

Building Codes and Wall Design

TO DESIGN AND CONSTRUCTION ENGINEERS alike, the article in this issue on the resistance of walls to wind offers a challenge to improve our building codes. Not only does the article emphasize that many codes are entirely lacking in provisions to safeguard walls during the construction period, but the author found that where such provisions are present they are usually inadequate. From his studies it can be concluded that engineers associated with building practice can render an important service by bringing codes up to date as they relate to wall safety. Fortunately, little damage, other than to the wall, occurred in the accident that started the author's investigation, but the failure gives warning of potential dangers that are much greater. With the construction industry as safety-minded as it is today, engineers should strive to bring about any necessary code changes without delay.

Less Water—More Fuel

SHORTAGES OF FUEL threaten to limit our war effort this winter. Conservation of fuel, therefore, becomes more important than in normal times. One way to save fuel is through a reduction in water consumption in all communities where water has to be pumped. By promoting such conservation, municipal engineers can make a valuable contribution to the war effort. Through local newspapers they can keep the need for such conservation before the public by setting forth the principal ways in which water is wasted. This campaign of publicity should be supplemented by visits to industrial plants using large quantities of water to interest their managers in water conservation. Indirect but still very real benefits from such a campaign to conserve water are savings in chlorine (a critical war material), reduction in the load on water purification and sewage disposal plants, and reductions in maintenance and operating costs.

Welcome Realism

THE DECISION of the Western Defense Command to lift some of the dimout regulations in West Coast cities, and the order relieving civilians from aircraft spotter duty along the East Coast, represent a welcome, if tardy, recognition of the changed war situation. One can only hope that these developments foreshadow general abandonment of unnecessary, time-consuming and energy-sapping activities, properly begun in the interest of preparedness against air attack, but now patently out of date. Thousands of citizens, including many engineers, who have loyally devoted after-work hours to civil defense duties for many months, deserve a respite. Others who have had to drive cars at night deserve to be relieved of the strain of trying to see dimmed traffic lights. Relieving civilians of aircraft spotter duty can only mean that our coastal air patrols

and our military coast defenses are considered adequate to handle any situation that is likely to arise. If that be the case, a city's ordinary police force would now seem to be adequate to take over air raid warden duty. Manpower, not air raids, is the problem of the moment. Let's conserve it for useful work, and not tax the people's intelligence and strength by continuing unnecessary activities.

Engineers and Public Health

OVERSHADOWED, but nevertheless real, are the lesser "wars" that are being fought within the constellation of the fighting war. Among these other wars, there is one that holds special significance for the engineering profession, particularly that branch concerned with sanitation and public health. This is the fight to protect our troops from mosquito and water-borne diseases. Its importance was dramatized by Col. W. A. Hardenbergh, chief engineer of the Sanitary Corps, before the American Public Health Association last week, when he revealed that malaria and dysentery infections were responsible for 50 percent of all hospitalization of troops in fighting areas. This situation calls attention to a postwar public health problem —when our men return from service abroad, a large number will be carriers of malaria and other easily transmitted diseases. How we in the United States will be able to guard against the widespread dissemination of these diseases among a civilian populace is a challenge that commands not only the best thinking of the medical men, but the engineering profession as well. The extension of permanent mosquito control measures, for example, is one of the more obvious engineering activities that will require attention.

Postwar Building

A CHANGE IN THINKING in the building field is beginning to be apparent. Slowly, but with gathering momentum, emphasis is being shifted from the problems of emergency design and construction to those of a period when men and materials and machines again will be widely available. Significantly, the shift is occurring while considerable emergency building is still underway, suggesting that no time is going to be lost in the transition to postwar activities. How great these may be is not agreed upon, even among expert analysts, but the consensus appears to be on the optimistic side, as articles in a special section on buildings in this issue make clear.

Regardless, however, of the volume of postwar building, the design of the structures that will be built is sure to be affected by the enthusiasm for progress that two years of emergency conditions have engendered. Just to be able to design for permanency and economy once again will be stimulating in itself. And then, there is the hope that new materials with promising potentialities will appear on the market, and that some that were new but untried before the war will be available to offer challenging possibilities. Furthermore, some of the war emergency developments should not be forgotten, particularly the bold use of timber, for these, too, will give the postwar building design field an appealing and exciting quality.

Nor will opportunities for achieving fundamental improvements in design be lacking, one major development in this direction having already become apparent. This relates to the widespread interest of building manufacturers in so-called modular design, i.e., the dimensioning of their products in multiples of a standard module of four inches. Such a system of standardization has been discussed for two decades, but now the American Standards Association has taken the idea under its wing, and through the sponsorship of the American Institute of Architects and the Producers' Council, a large committee is at work, and substantial progress seems probable. Since material inventories are at low volume, manufacturers would seem to be in the best position possible to make changes in dimensions, while designers of postwar buildings could be expected to support and almost demand any kind of standardization that promises to save as much time, trouble and money as would the adoption of coordinated dimensions of such products as brick, structural clay, concrete blocks and window and door frames, to name a few of the many that can be standardized.

All in all, postwar building thinking is beginning to stir, and in a way that at this stage of the war seems proper, constructive and promising. The special section on 1943 buildings in this issue may well be the last that will reflect war emergency practice, but most important, each of the several articles contains some thought or suggestion that may have a postwar application.

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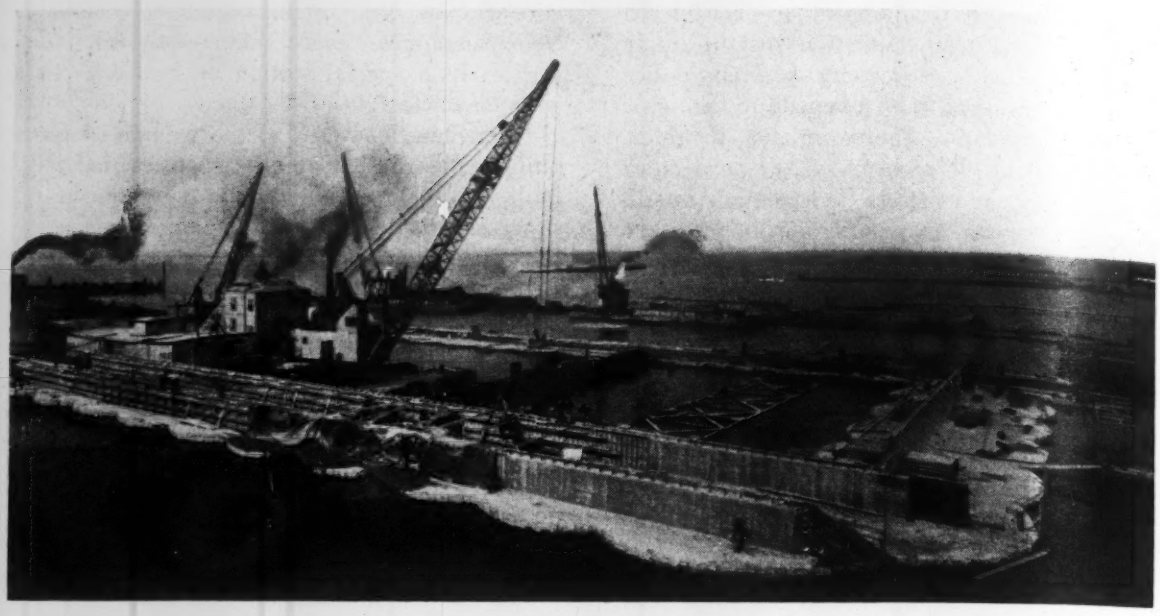


Fig. 1. Sheet-pile cells form the permanent walls of two submerged shipbuilding ways for an east coast shipyard.

Cellular Cofferdam Serves as Wall Of Ship Construction Basins

***Contents in Brief**—Using the sheet-pile cells originally planned for an enclosing cofferdam as the walls of ship construction ways built below water, Dravo Corp. saved material and had facilities for shipbuilding ready months earlier than would have otherwise been possible. "Sandpiles" were used to stabilize and drain the cells of the wall. Tremie concrete, on wood piling driven far under water, comprises the basin floor. At the outshore end, floating caisson gates were built in place inside a box cofferdam made of vertical 36-in., 350 lb.-beams and Z-piling.*

DUBBED "SUBMERGED SHIPWAYS," partly because original plans contemplated inclined shipways with their lower ends below water and protected by a cofferdam structure, two shipbuilding basins on the east coast are especially notable because their walls are composed of sheet-pile cells similar to those used in cofferdams. According to the job authorities, the name submerged ways was retained because it was desired to keep this installation out of the high-cost graving dock classification.

Regardless of title, the structure performs the function of a graving or drydock in providing a space where ships may be constructed on a level keel or may be brought in and the docks unwatered for necessary repair. Costs were much lower than for most conventionally built drydocks of comparable size, and were only moderately more expensive than the inclined ways first proposed for this location.

Basins have several advantages over inclined ways for ship construction. Ships may be built on a level keel eliminating the complex measurements that are required in referring to an incline; less bracing is required to hold preassemblies during fitting; outfitting may be done to any desired stage while in the dock as the load at launching time is not a consideration; and structural members in the ship designed to take poppet and way end pressures at launching may be eliminated.

Incidentally, some $200,000 in launching expense is eliminated by the simple expedient of turning water into the submerged basins and raising the ships off keel blocks rather than using the costly launching blocking, cradles and ways of conventional inclined ship construction.

There are two adjacent basins in this project, one 961x130 ft. and the other 1,000x142 ft. The smaller basin has a clear depth of 35 ft. over the gate sill and the larger one a depth of 40 ft. over the sill and 43 ft. in the docking area where keel-blocks are used. Original plan of construction of the semi-submerged, inclined ways was to build a large site-enclosing cellular cofferdam and then erect the permanent structure in the dry. The temporary cofferdam would have required about three-fourths of the length of sheetpile cells that the revised plan used in two side walls, a common center wall and inshore end of the docks built. Braced box-cofferdams were constructed at the out-

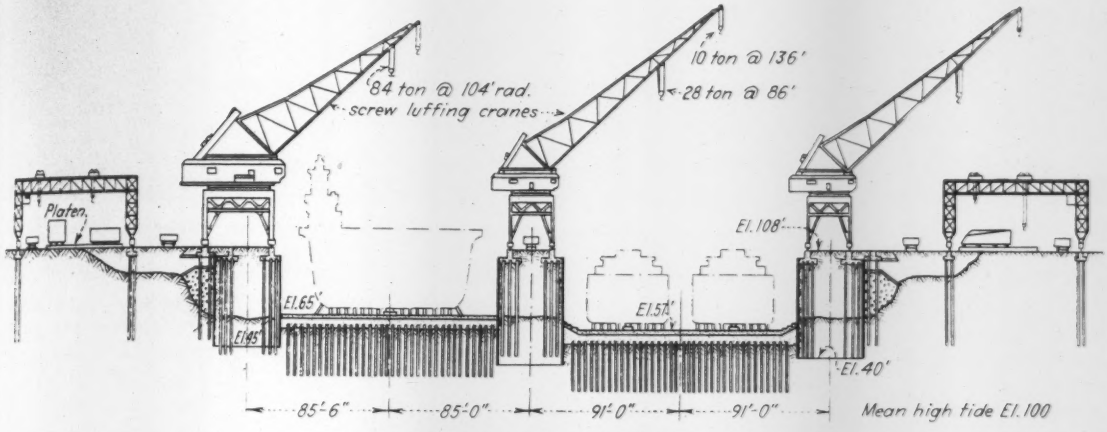
shore end to permit building a mass-concrete gate structure and erecting caisson gates in the dry.

Marl foundation

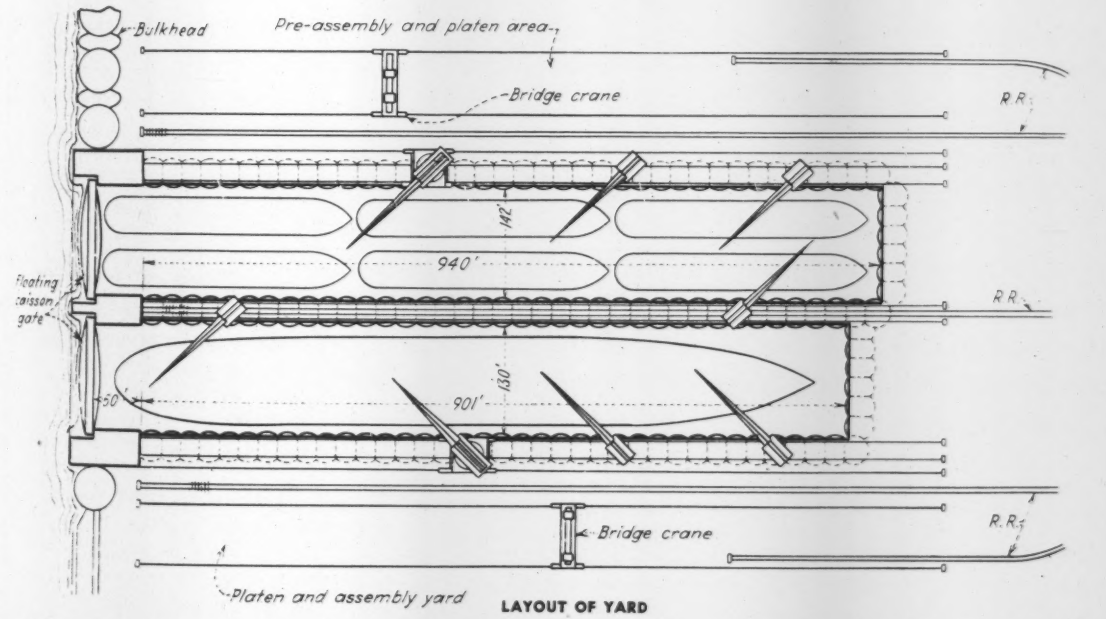
The site selected for the shipways is in tidewater with about 5 ft. of water at the shore end of the docks and 15 ft. at the seaward end. Material in the area is a marl, sandy yet highly cohesive, containing shell fragments and having a greenish color. The marl extends to a very great depth, and it was determined that this would provide an excellent foundation for the shipways as well as permitting the driving of sheetpiling to depths that would cut off the flow of any appreciable volume of water. Incidentally, the marl appears to have chemical properties that assist in preservation of the sheetpiling in salt water.

Sloping faces of the marl have stood for many years, with only moderate timber facing to serve as basin walls of three nearby graving docks. The marl had also been used as foundation material in the area and was found to be sufficiently stable to warrant its use in filling the cells. Sand and gravel fill material was preferred, but the great quantities required for such extensive filling were not readily available and transporting equipment was not at hand to fill the cells as speedily as required. Furthermore, excavation of the basin area required moving of more than sufficient quantity of the marl to fill the cells. In use, it was found that the marl did not drain as readily as had been expected, and it proved necessary to use "sand-piles", described later, inside the cells to expedite the drainage and consolidate the fill.

A layer of several feet of black, silty mud over the marl was removed by a 16-in. hydraulic dredge that wasted the material at some distance from the excavation. The dredge, equipped with a cutter-head, also ex-



CROSS SECTION THROUGH BASIN



LAYOUT OF YARD

Fig. 2. Only a few more sheet-pile cells were necessary to make the walls of ship constructing basins than would have been used for a site-enclosing cofferdam. A sandy marl underlies the entire site and was used for filling the cells and to "make" land for the assembly yard.

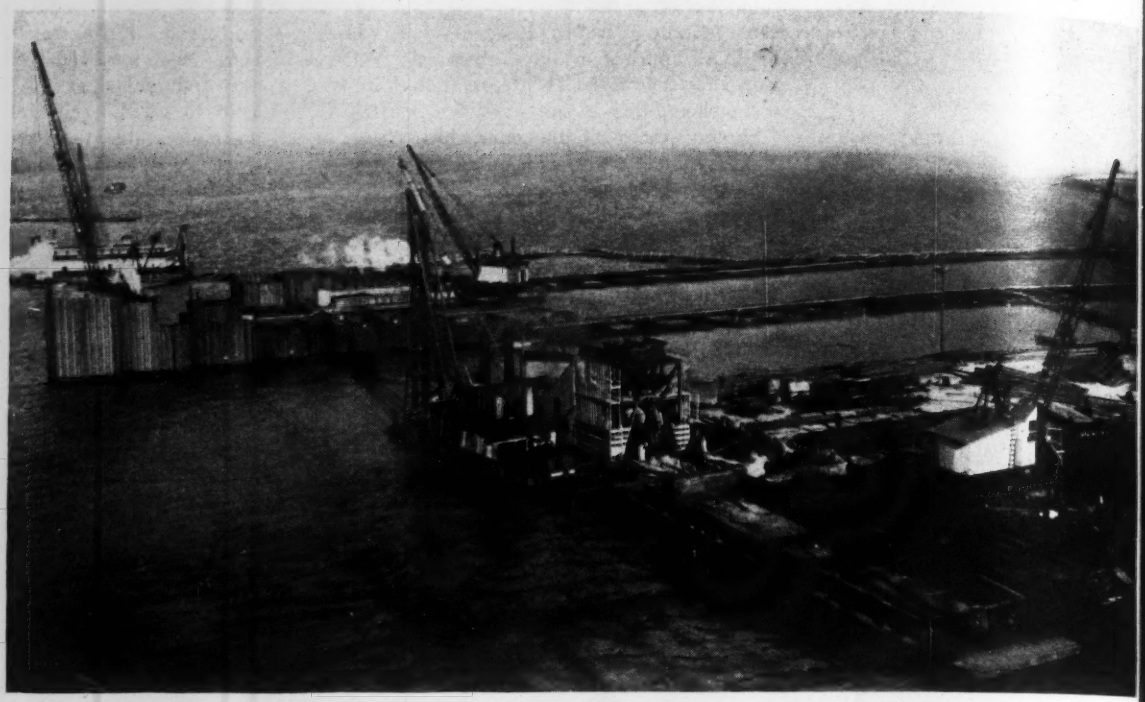


Fig. 3. Pile cells in right background have been driven to grade while those at left are staggered upward to avoid driving sheets too far in advance and out of interlock. Mixer-boat and pile-driver boat are being assembled in foreground.

cavated the marl along the proposed line of cellular walls to the depth of the shipway bottom. The marl inside the basin, except at the wall line, was left in place during wall construction for subsequent use as filling material for the cells.

The cells of the walls are of the cross-wall type with transverse walls of sheetpiling generally at 24 ft. 4 in. c. to c. The Y-sections at the cross walls are 33 ft. 10 in. c. to c. and the outside sheets are set to bulge to an arc 41 ft. out to out. Sheets used had straight webs of ½-in. thickness and weighed 28 lb. per sq. ft.

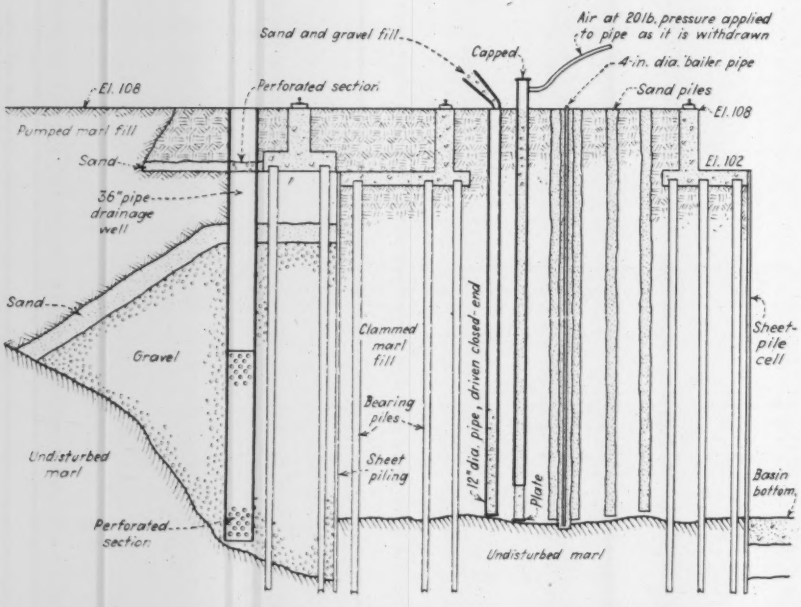


Fig. 4. Sand-piles, 25 to 40 per cell, were used to consolidate and drain the fill in the cells. Drainage of the land-side fill was necessary to relieve pressure, which initially forced some cells as much as 3 in. outward into the basin.

Due to expected high interlock stresses, specifications for purchase of sheetpiles required that a minimum interlock strength of 15,000 lb. per lin. in. be guaranteed. Manufacturers were able to supply this from their regular rollings by being exceptionally careful that interlocks were exactly correct and eliminating any pieces of which the rolling was not perfect. Lengths of sheets ranged from 56 to about 100 ft., determined by advanced driving of test piles. A 135-ft. boom on a derrick boat was used in handling sheeting; shorter boom rigs followed with swinging leads to do the driving.

Piling set accurately

Piling was driven to an accurate templet made of wood and held by steel spuds embedded in the marl. The templet was accurately spotted by instruments, and starting piles were spaced carefully so that the cells would conform to the plan. All piles around a cell were set before any were driven, and when driving was started it was kept fairly level, two piles being driven together and none advancing more than 4 ft. ahead of adjacent piles to prevent possibility of driving out of the interlocks. Cofferdam sheet-piles were driven to, or cut off at, 1 ft. above high tide level.

Cells were filled by digging marl with a heavy duty clamshell bucket operated from a derrick boat which deposited it directly in the cell. Some "borrow" was necessary, being brought to the cells by barge for clamming into position.

Filling followed closely behind the driving operation but fill was not permitted to rise higher than 10 ft. above that in an adjacent cell to avoid distortion of the cross wall. The marl used for filling was firm material, some of it in chunks as large as 1 cu. yd. Some broke into smaller pieces that naturally filled the voids. Soupy material floated to the top of the cells and washed overboard as filling progressed.

Fill material in the cells did not have sufficient stability to support the load of heavy gantry cranes required for ship construction. Consequently, wood piles were driven through the fill to good marl, and a concrete cap and beam used. The concrete cap and beam are designed for heavy loads and also serve to extend the wall height from the sheetpile cutoff at 1 ft. above high tide to 8 ft. above.

Cells move inward

Shortly after driving and filling of the cells in an area was completed, backfill along the outside of the wall was started to "make" land for a platen and assembly area. Because of the necessity for using practically all of the marl from the shipway excavation in the cells, the fill back of the cells, made by hydraulic methods, consisted of relatively unstable silt and clay.

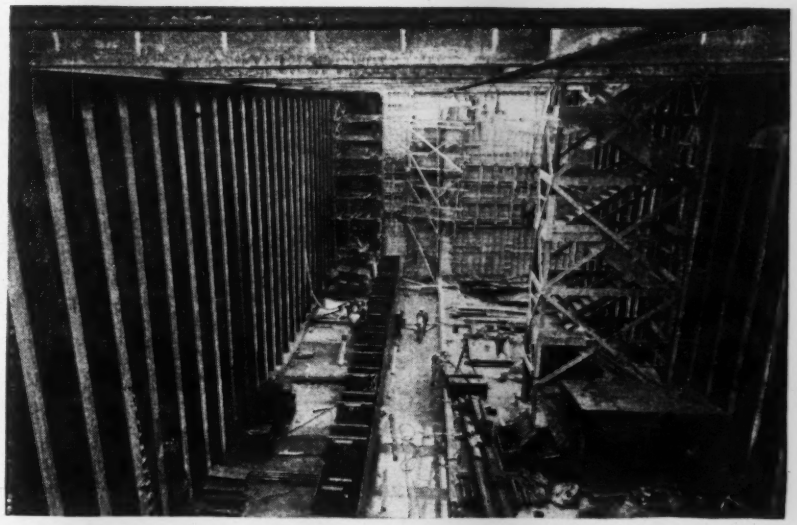
Before the plan level of 8 ft. above water was reached, it was noted that the cellular wall had deflected inward to the extent of 3 in. opposite the point of greatest load from the hydraulic fill. Filling was stopped and means taken to stabilize and artificially consolidate the material inside the cells.

The contractor, the Dravo Corp., had foreseen from the start of the work that some means of stabilizing the fill might be necessary and suggested "sand-piles." After extensive investigations and tests this method was recommended by Dr. Karl Terzaghi, consulting engineer for the contractor.

The sand-pile was made by driving a closed-end, 12-in. dia. pipe the full depth of the cell, filling it with sand and gravel and withdrawing the pipe, leaving the vertical plug of porous material to serve as a drain. The pipe was driven closed-end to consolidate the existing material and assist in squeezing water from the marl. A loosely attached plate at the bottom kept material from entering the pipe, yet dropped off easily as the pipe was withdrawn. The pipe was filled with a mixture of clean sand and gravel in a proportion of 15 and 85 percent, the materials being put through a concrete batching and mixing plant for accurate proportioning by weight. After filling, the top of the pipe was capped air-tight and air, under 20 to 30 lb. pressure, applied to force the gravel out as the pipe was pulled up by a derrick.

The first of the sand-piles driven was placed in the center of the cell and, after driving, but before placing of the sand-gravel fill, a 4-in. dia. pipe with slotted bottom was placed inside it to act as a "bailer" from which water could be removed by pumping or bailing. The 4-in. pipe was held in the center of the larger opening by guides to assure that it would be surrounded by the sand and gravel fill placed prior to removal of the 12-in. pipe (Fig. 4).

Pipes were driven in circles radiating from the central pipe, but none



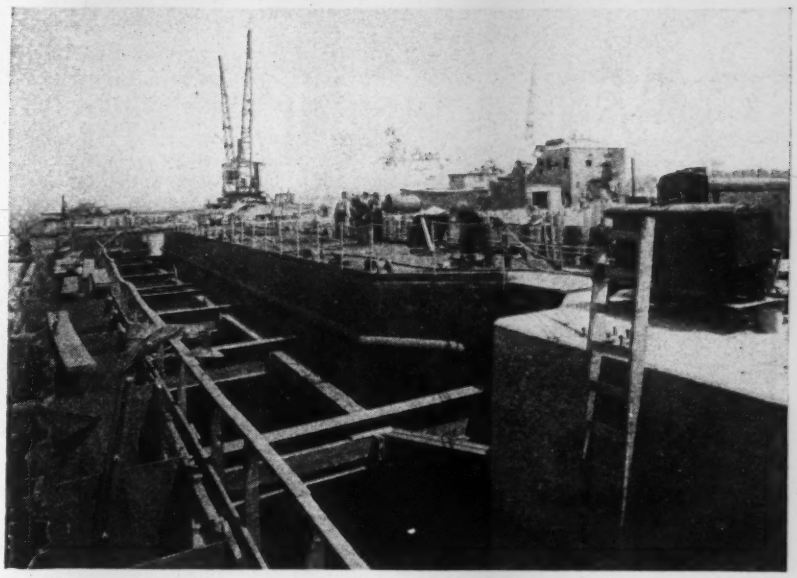


Fig. 5. Floating caisson gates to close the outshore end of the ways were built in place inside a box cofferdam. Above, bottom of gate is started 8 ft. outside the closure sill with a 42-ft. clear vertical height for construction. Below, exterior of nearly completed gate with struts through top to resist cofferdam thrust. Note vertical 36 in. beams with three sheetpiles between.

Fig. 6. Screw-luffing crane has no "boom-lines." Loads to be accurately set can be lowered to near position by load line and finished off by slow screw motion.

except the central one had the 4-in. bailer pipe insert. The added pipes for the sand-piles squeezed the water to the bailer pipe with the result that water was removed to an elevation 25 ft. below tide level, thus consolidating and stabilizing the filling material in the cells so that the tendency to deflect was not excessive.

In each of the 24x40-ft. cells about 25 to 40 sand-piles were driven. The number placed in a particular cell was determined by resistance to penetration of the closed-pipe shell.

Cells permanently drained

After the dock was completed and pumped out, horizontal drain pipes were driven through the inside wall of sheetpiling to the central sand-pile, thus providing permanent drainage of the sand-pile without pumping or bailing. The horizontal pipe is fitted with a swing-check valve at the discharge end to prevent water rising in the cells at the time the shipway is flooded to move ships out.

To relieve further the pressure on the cells, caused by the unexpectedly high horizontal pressure of the hydraulically placed backfill, a wedge-shaped section of coarse gravel was placed along the outside of the exterior walls, Fig. 4. Gravel was 6 in. maximum size, and the wedge was permanently drained by four 3-ft. dia. drainage or pump wells extending to the bottom of the fill. This wedge-shaped section extends to about 10 ft. below the high tide level, its surface being blanketed with some 2 ft. of sand to prevent mud from permeating the gravel and again producing the high horizontal pressures against the sheet-pile cofferdam.

The hydraulic fill was then continued, using the best available marl to above the high-water level near the cellular walls and the poorer, silty material to a height of 8 ft. above tide level. The open wells were carried to the top of the fill and kept constantly unwatered to relieve pressures on the walls and to produce more rapid compaction of the cell filling material.

Timber piles over basin bottom

While the construction, filling and consolidation of the cofferdam were in progress some 13,000 timber piles were driven under water to provide support for the concrete bottoms of the two basins and to resist uplift due to water pressure when the basins are pumped out and empty. General excavation was made to a depth of 50 ft. below high tide in the deeper basin, 8.5 ft. below final floor, most of the material going to the cells as fill. Immediately behind the excavation a floating driver placed 35 ft. and longer piles so that their tops were 2 ft. above the excavation and some 48 ft. below the water surface. Before driving, the piles were notched to provide additional bond for resistance to uplift of the basin.

The next operation in the construction program was placing an underwater seal of concrete over the entire basin floor. This seal was 6.5-ft. thick and was poured in sections 48 ft. long and the full width of the basin between cellular walls. Such a monolith required 1,200 cu. yd. of concrete, placed without interruption.

The form used to confine the forward end of the concrete was a row of sheetpiles set along a row of the timber foundation piles. The sheetpiles were not driven, but their own dropped weight caused them to sink sufficiently into the marl to form a cut-off. The sheetpiles extended to above water and their top was held to a straight line by a floating-truss whose ends were lashed at each end to the cellular walls. After concrete placing, the sheetpiles, which served as forms for the forward edge of the concrete, were easily withdrawn for re-use.

Concrete for all underwater placing was mixed on a steel hull floating plant equipped with steel bins and two 2-cu. yd. non-tilting electric mixers and a full-revolving steam crane for handling aggregates from barges alongside. Cement in bulk was picked up from a cargo barge by a portable electric screw and blower pump for transfer to bins above the mixers.

Concrete was placed by a floating derrick boat using a 2-cu. yd. sub

marine bucket for under-water placing. Canvas flaps were used over the bucket to prevent washing out of cement, and in all cases the bucket was lowered to contact with previously placed concrete before automatic dumping. The mix used contained 6.7 sacks of cement per cu. yd., about one sack more than the conventional 1-2½-4 mix, to allow for the 6 in. slump that was to assure easy flow-ability and to compensate for cement loss through washing. Cores taken from the tremie concrete in the bottom of the basin after unwatering showed a compressive strength of 3,000 psi. or more.

Concrete was started at one wall of the basin area and continued across to the other side, engineers continually checking to assure that the top level was approximately correct and that no areas were missed or left long enough that initial set of the concrete might take place.

Because it was not known how much water might permeate the marl from below, extensive precautions were taken to relieve any possible hydraulic pressure on the bottom of the basin. Relief pipes, 4-in. in dia., were used at 22-ft. centers across the basin near each of the 48-ft. c. to c. construction joints and at about 12-ft. centers along the exterior walls of the shipways. The pipes were set by use of an extension to the surface of the water, coupled by a sleeve to the pipe to be left in the concrete. After concrete had taken its set, the extension pipe was unscrewed and re-used in subsequent pours.

At the outshore end of each of the basins, mass concrete walls on subaqueous timber piles were used instead of the sheetpile cells to take the thrust of a floating caisson gate over a span of 140 ft. and depth of 50 ft. This concrete section extended 80 ft. inshore from the gate and was built inside an internally-braced cofferdam of steel sheetpiling.

It was necessary to rush this permanent gate construction ahead of pumping out of the shipway as the cofferdam structure would not resist the load with water on only one side. Construction was done in two stages. A cofferdam enclosing the center wall, one outside wall, and the gate was built and the work inside it completed. The material was re-used in constructing the other outside wall and the second gate. Pumping equipment for unwatering and the valve chambers for flooding the basins were installed in the center wall, common to the two basins.

Unusual cofferdam at gate

Stable marl was at a considerable depth below water at the outshore end of the gate cofferdam, it being necessary to go to depths of over 100 ft. to reach firm material. The gate cofferdam was constructed so that the floating caisson could be erected approximately in place, requiring a horizontal span of 140 ft. and a clear vertical span of 42 ft. The design adopted consisted of vertical "master-beams" braced at just below the sill by a 10-ft. thick tremie seal and above the water by steel struts. Outside the cofferdam all material was excavated to 35 ft. below low water to reduce the pressure on the cofferdam.

The master-beams, to span the 46 ft., were specially rolled 36-in., 350-lb. sections, many of them spliced to 108-ft. long. These were spaced 5 ft. 4 in. apart with three sheet-piles filling the opening between. The master-

Fig. 7. One of two submerged ways is pumped out and leveling course of concrete is being placed while cell and gate caisson construction continue at right for second basin.

beams, with one sheet-pile attached, were driven very accurately to planned location in a steel guide frame. Intermediate piles were placed later.

Wood supporting piles were driven by submarine hammer inside the cofferdam and a tremie seal was placed before unwatering. Drains, of 4-in. dia. pipe, were placed at frequent intervals through the seal to relieve hydrostatic pressures. Here the underwater concrete was placed through a 10-in dia. tremie pipe, and the cofferdam pumped out after seven days, very little leakage being found during this operation.

No interference from bracing

The method of constructing the cofferdam eliminated bracing that would interfere with the permanent structure so the concrete work, with granite sills and seats embedded, proceeded rapidly while the steel caisson gate was assembled complete and in place except that it was 8 ft. back from closed position. After completion of the gate, it was jacked to closed position and held there while water was let into the cofferdam.

By the time the gate was in place the rest of the submerged shipway walls and floor were complete and the entire basin was pumped out, using a single 15-in. vertical pump that was capable of removing the water as rapidly as seemed expedient.

Elaborate preparations were made to observe the behavior of the shipway during unwatering. Transit lines were established to observe possible deflection of the individual cells, piezometer gages were installed and an accurate watch kept for indication of excessive hydrostatic head. As the water was pumped down drain holes were burned through the inner wall of the sheet-pile cells to prevent building up hydrostatic head inside the cells. No difficulty was encountered, and unwatering proceeded as scheduled.

Unwatering of the cofferdam exposed mud that had been carried into the shipway by tidal action and required removal by clamshell and washing down to a sump to clean the concrete. Laitance from under-water concrete placing was removed, and the few high spots in the concrete were cut down with pneumatic breakers.

The next operation was placing a 2-ft. thick leveling course of concrete over the floors of the basins, the relief pipe placed through the seal concrete being extended to the surface of the shipway floor. Concrete in the floor was placed by full-revolving cranes temporarily located on top of the shipway walls and taking concrete from the floating plant for placing by manually dumped, 2 cu. yd. concrete buckets.

The vertical master beams and sheet-piles of the gate caisson cofferdam were cut off inside the basin after unwatering; beams and sheet-piles on the exterior were cut off below the sill level by submarine torch operated by a diver.

Inserts for holding steel blocks were placed with the 2-ft. thick leveling course of concrete. Immediately after the leveling course was completed utility lines, fresh and salt water, electricity, compressed air and gas lines were installed. Ramps were built to accommodate workmen moving in and out of the basins, eliminating so far as possible the usual ladders and stairways. Permanent pumping equipment was installed in the wall between the two basins and special shipbuilding cranes were built in place on the interior and exterior walls.

New shipyard cranes

The cranes in use at this yard are a new type of full revolving gantries with screw luffing arrangement designed and built by the construction contractor's engineering works division. Two sizes of rigs are in use, one with a capacity of 28 tons at 86 ft. and 10 tons at 136 ft.; the other having a lifting capacity of 84 tons at 104 ft. The smaller cranes have a triangular boom with a single luffing screw while the large rigs have a rectangular shaped boom, the two top members of which are connected through a pair of rotating screws, entirely eliminating the usual boom cable.

The submerged ways were suggested, designed and built by the contracting division of Dravo Corporation, Pittsburgh, Pa.

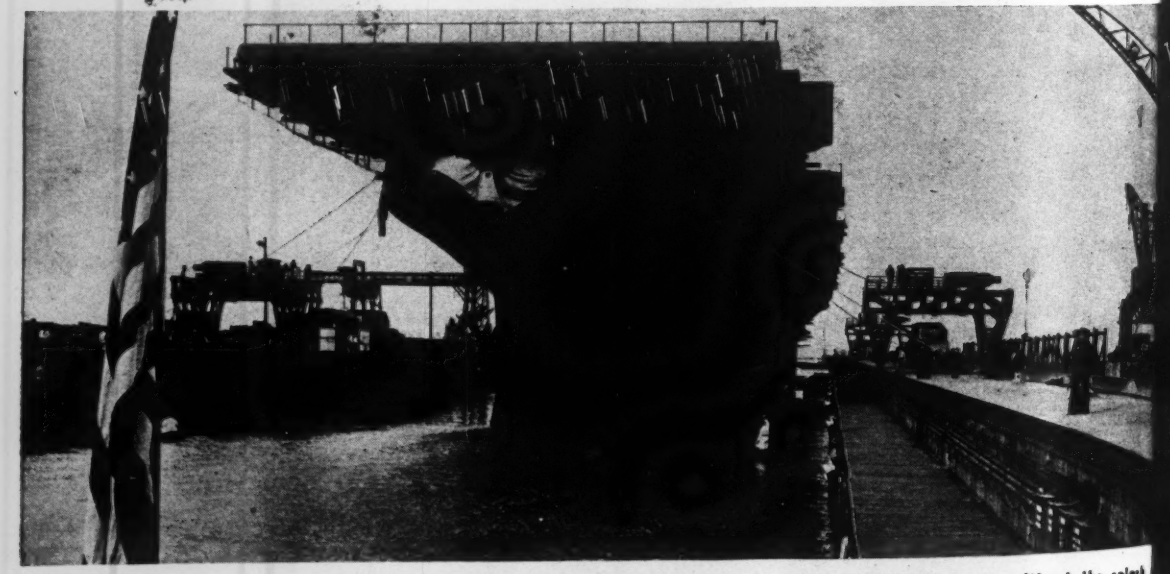


Fig. 8. The Intrepid, one of the Navy's newest big carriers, floats easily out of the building basin without the splash stress accompanying the usual launching. One of the screw-luffing cranes may be seen at right.

Fig. 1. Unlike fog, palls of black smoke cannot be penetrated by photographing with infra-red film.

Protective Concealment for Reservoirs And Exposed Aqueducts

***Contents in Brief**—Experiments with smoke screens laid over reservoirs to prevent light from being reflected upward from the water surface have developed data on effective methods, including characteristics of the smoke layer under different wind velocities and sources of smoke. Hourly cost of smoke production also is made available.*

SURFACES OF LAKES and reservoirs have such high light-reflecting quality, as compared to the surrounding terrain, that when viewed from a high-flying airplane they are often more conspicuous and more useful in orienting aviators than any other major topographical feature. If the light-reflecting surfaces are screened, even slightly, considerably more time is required for a bombardier to orient himself and get exact bearings. Because time is so short at high speeds, only a few seconds of uncertainty as to location may destroy the effectiveness of a bombing raid. Therefore, in planning protective concealment of reservoirs it is not necessary to totally "conceal" these outstanding landmarks. The objective, rather, is to render them less conspicuous from high altitudes by reducing their light-reflecting quality by some form of screen.

For such large areas as are involved in lakes and reservoirs, the only practicable screen would be one light enough to float in the air, i.e., some sort of vapor or smoke. Naturally, then, the logical starting point in experiments was the smoke pots that have been developed by farmers in search of effective and low-cost producers of smoke and haze as a means of preventing the freezing of fruit on orchard trees. Much information on design and operation of smoke pots was available, and based on these data "smoke guns" using an oil burner in an 8-in. pipe (the gun barrel) were made. These tests gave results less satisfactory than those attained later by simply allowing the oil to burn in open pits without the aid of any burner at all. When the effectiveness of oil pits had been demonstrated, the study moved on to questions of proper location, spacing, shape and size of the pits that would most effectively screen a given area of reservoir surface.

Before the successful location of oil pits can be determined, careful studies are required on the direction of prevailing winds, much as is done before deciding on the location of major runways at an airport site. Pits must be so dispersed that some always will be available on the upwind side of the area to be screened. Smoke rises from such pits, it was observed, on a vertical angle of 1–3 and spreads, in moderate winds, on a horizontal angle of 1–5. The rate of burning in pits of different shapes appeared to be about the same. However, the square or round types are believed to be less conspicuous at night than long pits as flames from them are more intermittent and do not make a long line of small flames, more or less continuous in appearance.

Fig. 2. The high light-reflecting quality of the water at the left is in sharp contrast to that under the smoke pall at the right.

Fig. 3. Typical angle of smoke ascension near the oil pit in a 5-m.p.h. wind. This pit is consuming 36.6 bbl. of 13-g. oil per hour.

The large size smoke screens required for the ordinary reservoir made it economical to use power equipment for excavating pits 2 ft. deep and of sizes ranging up to 300 sq.ft. or more. Such pits require only a relatively small amount of hand work in squaring up the corners and were dug at a cost of $7 or $8 per pit. Where transportation from oil fields is not too costly, these pits can be operated with fuel oil of 13 g. at a cost of not much more than $30 per hour per pit, producing an enormous volume of black smoke. When strategically located around reservoirs, such pits will emit a screen that practically eliminates the reflection of light on the reservoir surface, making it almost invisible from high altitudes. Wide variation in the density of the smoke clouds was observed for different pit and wind conditions.

Effective dispersion of the smoke cloud may not occur in less than a horizontal travel of 1,200 to 3,000 ft. This was observed with pits 600 ft. apart, indicating that the spacing of pits should be one-fifth the distance they are removed from the line along which the protective screen is to be effective.

In a wind of 5 m.p.h., the provision of one square foot of burning oil surface per linear foot of desired screen coverage was found to produce a smoke cloud density that would prevent photographs from showing the body of water. For wind velocities between 10 and 15 m.p.h., it is suggested that 2 sq.ft. of pit burning surface per linear foot of desired screen width is desirable. Similarly, for 20 to 30-m.p.h. winds, 4 sq.ft. of pit area per linear foot of smoke screen is indicated.

For oil of the analysis given in the accompanying table, it was found that for one hour's burning, a pit would require to be fed an amount of oil equivalent to a depth of 6 in. In a pit of 389-sq.ft. area in which this oil was used, 5 gal. of gasoline was poured on the surface and lighted with a match. This method of igniting started the fire effectively over the entire pit within 5 sec. Within a few more seconds, smoke of maximum density was streaming upward.

Physical Properties of Oil Burned in Pits is as follows:
Flash 245 deg. F.
Fire Point 300 deg. .
Gravity 15.2 deg. A.P.T.
Viscosity 77 deg. F. (Saybolt Furol: 1340 seconds)

Tests were made on burning this oil after 2 in. of water had been poured into the pit and allowed to stand under the oil for 24 hours. The smoke was materially reduced in quantity, was more gray in color and more flame appeared at the surface of the oil. This indicates that the oil should not be allowed to remain in the pits during rain.

Fig. 2 shows a picture made 20 in. after igniting six oil pits with total surface area of 2,165 sq.ft. These pits were located on the upwind side of the reservoir but did not extend entirely across the reservoir width. These pits, combined, burned oil at the rate of 180 bbl. per hour.

The picture reproduced in Fig. 1 was made with the camera slightly below the top of the smoke and on a level with the top of the haze. Note that under these conditions and for this wind velocity (about 7 m.p.h.) the smoke rose only to a certain level and thereafter maintained that level in its advance downwind.

Fig. 3 shows a picture taken after 1 min. of burning in a wind velocity of 5 m.p.h. Consumption of oil in this pit was at the rate of 36.6 bbl. per hour.

Photographs made with the use of various filters and either infra-red or super panchromatic press emulsions did not obtain any material penetration of the black smoke. In other words, these smoke screens were as effective in concealing the water surface from photographic records as from the eyes of aviators.

Concealment for aqueducts

From high altitudes an object on the ground such as the long line of an aqueduct, usually resplendent in a coating of aluminum paint, is a conspicuous landmark. When such a guide-post is punctuated with elevated water tanks and towers, similarly painted, whose locations are, of course, carefully marked on the enemy aviator's map, it becomes a hazard to a community that is in danger of aerial bombardment.

Aluminum paint is probably more conspicuous than any other coating that could be applied, so far as high altitude visibility is concerned. In addition to being light in color, a curved surface coated with it reflects light of penetrating quality at almost all hours of the day and to all quarters of the sky.

In finding means of protective concealment, it is not sufficient to merely change this color. In parts of the country where the possibility of enemy attack is believed to justify repainting, endeavor is being made to repaint with a view to still another painting perhaps within a few months, as seasons change the color of surrounding terrain, and certainly again after the war is over. An important consideration thus becomes the quality of the new coating with respect to its later removal or its service as the base on which to superimpose later coats.

Fig. 4. Smoke screen plume over a reservoir, looking upwind, with smoke well dispersed over the entire area.

With this in mind experiments have been made with casein, asphalt, cement and many other bases, putting the paints on over the aluminum coatings and later trying out their relative merits as a base for still other coats.

For example, several miles of large steel pipe required some kind of paint that could be applied by spray gun. It was found that different paint bases required different types of spray guns. With a compressor delivering 130 cu.ft. of free air per minute at a tank pressure of 100 lb. per sq.in. and nozzle pressures of 75 lb. per sq.in., two men were able to paint 1,000 ft. of 9-ft. steel pipe in 8 hours.

In a region where there were prolonged foggy periods, it was necessary to adopt a paint that had a water base. The fogs kept a film of water on the metal so much of the time that paints with other bases were not practical. Asphalt emulsified with water, however, could be applied even between showers.

A difficulty with the asphalt paints was that color had a tendency to vary with the moisture content at the time of application. Some of these paints faded: others turned darker resulting in an undesirable contrast with the color of the surrounding terrain.

No advantage was found in buying durable quality in paints where seasonal changes necessitate repaintings several times each year. For example, in locations where the adjoining green verdure in springtime called for colors highly unsuitable to the yellowish-brown of late summer and fall, there seemed to be no alternative to two paintings yearly.

Tanks and water towers require much the same treatment as do large aqueduct pipes, and most of the same considerations apply.

Where hillside cuts show large areas whose color is in contrast with the adjoining vegetation, thus identifying the alignment, it has sometimes been found feasible to sow fast-growing plants that soon modify this contrast. Where the cuts and fills are too steep or too rocky and arid to permit of vegetation growth, asphalt emulsions have been used successfully to greatly lessen the color contrast with adjoining areas.

Work described was by an American city that cannot be identified.

Locomotive Drafted To Operate Water Pumps

Steam for operating one of Pontiac, Michigan's water-pumping stations during installation of new equipment at the city's plant, was obtained from a railroad locomotive drafted into service for that purpose. The locomotive easily kept one pump going that maintained a flow of 5,000,000 gpd. into the city water mains, and experimental tests showed sufficient steam was produced to operate an additional 8,000,000 gpd. pump.

Chicago's First Subway Placed in Operation

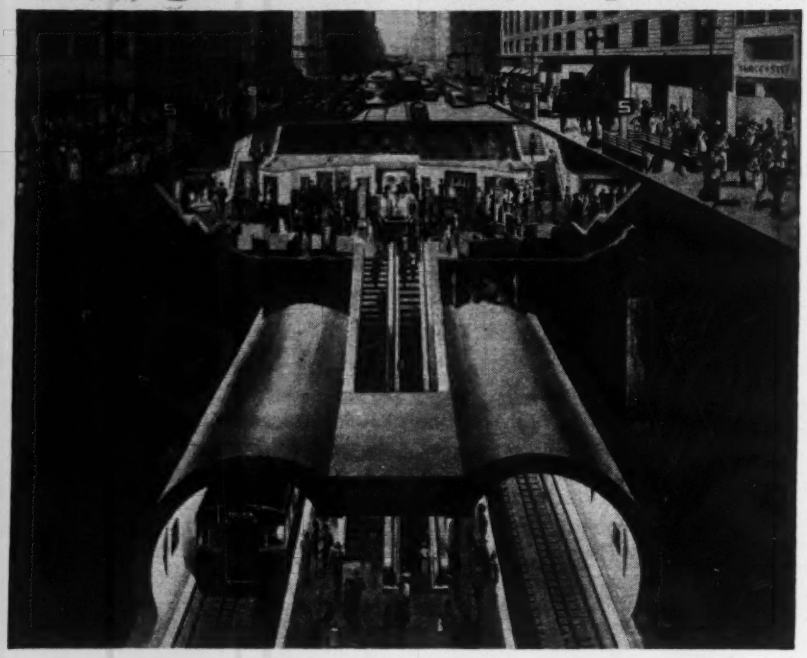


Fig. 1. Stairs lead from four sidewalk entrances to the mezzanine floor while both stairs and escalators lead on down to the loading platform, as shown in this perspective of a downtown station.

***Contents in Brief**—The first link in Chicago's long-needed and long-promised subway is now in operation along the State St. route through the Loop shopping district. Connecting with present elevated lines to the north and south, the new 5-mile twin-tube underground line speeds up north and south traffic and relieves some congestion in the famous elevated Loop section. The mezzanine stations include escalator access to and from platforms at train level. Modern lighting, ventilation and train control add to the safety of the new route.*

WITHOUT BENEFIT OF FANFARE or flag-waving Chicago's State Street subway was placed in normal operation at 12:01 a.m. October 17. Completion of this 4.9-mi. long unit of the city's two-track, rapid transit subway, costing $34,000,000, was formally celebrated the day before when all stations and facilities were thrown open to public inspection. Public reaction was one of amazement to discover this modern subway, under construction nearly five years, is in reality an underground electric railway system of the first order.

Officially designated as Route 1 in the city's comprehensive system of subways designed to embrace 55 miles of line ultimately at a cost of some $275,000,000, the State Street subway is of twin-tube, low-level design, with one track in each tube. It connects with the present four-track north side elevated route near Armitage Ave., 3½ mi. north of Madison St. and extends under Clybourn Ave., Division St., and State St. to a connection with the existing three-track south side elevated lines near 16th Street, 1½ mi. south of Madison.

Downtown traffic relieved

Many benefits to be derived from the operation of the State Street subway are readily apparent; others will become evident with its usage. Its principal objective is to provide terminal facilities for the rapid-transit lines to relieve the badly congested elevated loop in the center of Chicago.

For many years engineers have realized the inadequacy of the present facilities of this system. Traffic from 13 lines of elevated tracks is delivered to this two-track loop; 4 from the north, 3 from the south and 6 from the west side of the city. The loop is about 2 mi. around with cars operating in the same direction on both tracks. Elevated trains on the inner track cross over the outer line upon entering or leaving the loop. This congestion of traffic within the loop, together with the interference from trains crossing the outer line retarded loop traffic to about 7 m.p.h. during the daily peak load, resulting in overcrowding of trains and generally unsatisfactory service.

The new subway will relieve this congestion by channeling a large portion of the north and south traffic directly into the loop area, thereby reducing the maximum hourly train movement on the loop structure from 68 to 38 per track. In addition, seven minutes will be cut from the time formerly required to travel completely around the loop.

In addition to supplying better terminal facilities within the loop, the subway will make a direct time-saving of about eight minutes for traffic coming from the north part of the city into the loop. Likewise an estimated saving of 3½ minutes will be made by traffic from the south. While these savings in travel-time are not spectacular as they affect individual passengers, they nevertheless assume sizable proportions when considering the total time saved by the thousands of passengers using the subway daily.

Another substantial benefit to be derived from the subway is the opening up of new residential areas to direct rapid transit service through subway stations being located in districts heretofore remote from rapid service to the downtown area.

As the general public becomes conscious of the advantages of this new improved service, the rapid transit lines will play a larger part in Chicago's local transportation. At present they carry 16 percent of the total transit traffic as compared with 60 percent carried by the rapid transit in New York. Additional street capacity will be provided also by the subway attracting riders that now use surface facilities. And lastly, the State Street subway, as will be the Dearborn Street subway when completed, is a big forward step in providing substitute rapid transit lines that will permit the ultimate removal of the entire elevated loop structure.

The Dearborn Street subway, designated as Route 2, in the "initial system of subways," is designed to serve the west and northwest areas of the city. It will connect with existing elevated lines at Evergreen and Milwaukee Avenues to the north, extending along Milwaukee Ave., Lake St. and down Dearborn St. to Congress St. where it will turn west and end in a turn-back loop between Wells St. and the Chicago River. The excavation and concrete work for the tunnels and stations on this route are substantially finished but further construction has been postponed until after the war. Two mezzanine stations are completed.

Completion of the State Street subway, as the first unit in Chicago's master subway plan, terminates 34 years of intermittent planning that started with the "John Ericson Plan" proposed in 1909. Various schemes were proposed from time to time until early in 1937 when Mayor Edward J. Kelly suggested in printed form the fundamentals for a practical solution of the city's vexatious transportation problems. Detailed studies of the plan were made by expert engineers and an application was filed with PWA for a loan and grant for constructing a subway system.

In the latter part of 1938 the PWA engineering commission recommended some revisions in the proposed subway routes and the city amended its application requesting a grant of $18,000,000 of PWA funds to be matched with $22,000,000 of city funds for constructing the subway in accordance with the commission's revised plan. An additional grant of $5,000,000 from the FWA was approved by the city council in 1940, thus permitting release of city funds for construction of the turn-back loop on Route 2; not previously planned.

Much work done to date

Actual construction was started December 17, 1938 and by April 1, 1942 approximately 78,000 lin. ft. of single tube had been excavated and lined with concrete, comprising all tubes in tunnel for the State Street route and all of the same type tubes in the Dearborn Street subway except the Congress Street extension.

At the inception of the program, experienced tunnel designers and construction engineers were given leave from the Sanitary District of Chicago to work in the Department of Subways and Superhighways. Design and construction of this large-scale project was expedited at such a rapid tempo as to require a large, well-organized engineering force. Starting with some 60 engineers, it was built up to a peak of 550 men, slacking off to a current force of about 180. The engineering force was formed of four divisions; administrative, design, surveys and construction.

Inclines built of old steel

Construction of the incline connection at the north end of the State Street subway, near Armitage Ave., was completed early in 1943, while the connection near 16th St. at the south end was not finished until a short time before the opening date. These incline connections, carrying the two subway tracks, are of all-steel construction employing a deck system of girders supported by girder and column bents. Old steel beams, columns and bracing from the elevated structure were used wherever feasible in the new inclines to minimize the need for new steel.

To provide clearance for routing cars from the elevated tracks down the incline connections and onto incline structures connecting to portals of the tunnels, the elevated tracks are spread apart, forming a double or single-track run-around. Intervening between the lower end of each incline connection and the portal of the twin subway tunnels is an incline structure built on the ground with a sand-fill roadbed retained by concrete walls.

Routing of trains from the elevated tracks either onto the inclines or the run-around tracks is accomplished by an interlocking system of track

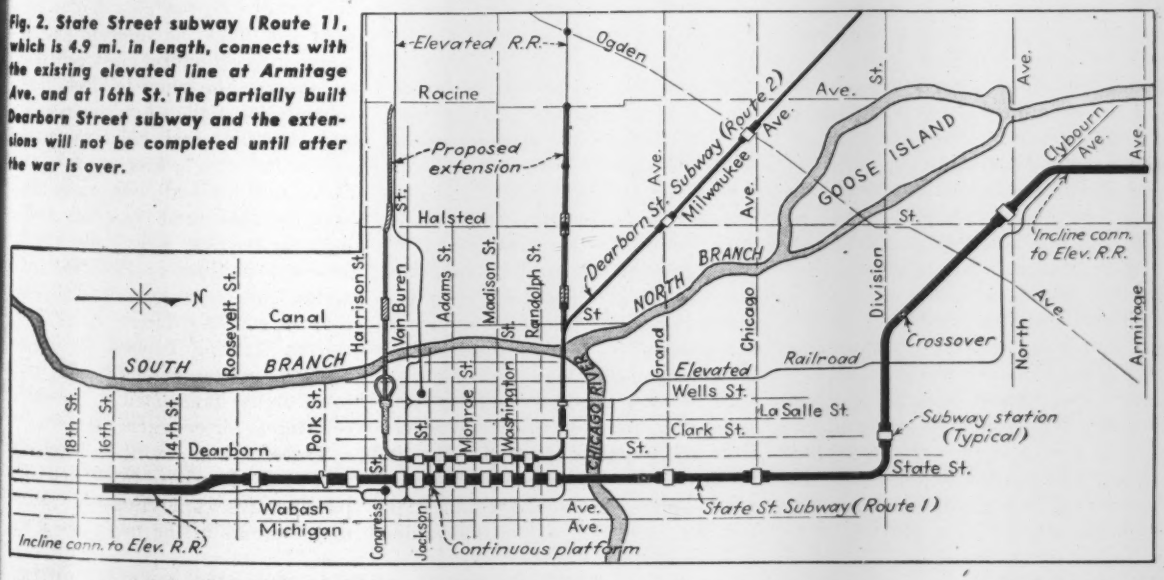


Fig. 2. State Street subway (Route 1), which is 4.9 mi. in length, connects with the existing elevated line at Armitage Ave. and at 16th St. The partially built Dearborn Street subway and the extensions will not be completed until after the war is over.

Fig. 3. At train level the stations are well lighted and of a design to permit easy cleaning and maintenance.

switches and crossovers operated by compressed air controlled from interlocking towers at each end of the subway. There also is an interlocking plant in the tubes at 13th and State St. where both subway tracks connect to a stub terminal. Mounted on the control boards of each interlocking machine is a miniature diagram of the tracks, switches and signals of the interlocking plant. Small electric lights behind the diagram indicate a train's location as it approaches and moves through the plant. By manipulating various buttons the plant operator sets up the route for a train, causing the switches to be automatically positioned and the block signals to be cleared.

In general the subway tubes were constructed by tunneling to minimize interference with normal street traffic. Some open-cut was made for installing tubes adjacent to the portals. Tunneling, hand-mining and multiple bench-method in outlying sections and shield driving in the loop was described in *ENR* Aug. 1, 1940, p. 159, and Jan. 30, 1941, p. 158. Twin-tube or two single-tube, low-level concrete structures are used throughout with one track in each tube. At the Chicago River crossing on State St. a twin-tube, concrete-lined prefabricated steel tunnel was sunk in a trench below streambed to avoid excessive grades in the subway profile. Throughout the downtown section the base of rail is about 44 ft. below the street surface, while in outlying areas the rail is located at a 48-ft. depth.

Three subway stations are located outside the loop area with loading platforms on the outer side of each track and three with platforms centered between tracks. Platforms are 500 ft. long and they will accommodate a train of eight 60-ft. cars. Within the downtown section between Congress and Lake Streets there are eight stations: one centrally located in each city block and all connected by a 3,430-ft. continuous island platform between the two tracks. Island platforms are 22 ft. wide and side platforms 12 ft. They are 40 ft. below sidewalk level in the downtown area and from 40 to 44 ft. at the outlying stations. Construction procedure for excavation and street decking for the stations was reported in *ENR*, May 21, 1942, p. 854.

Modern features of engineering design and construction are incorporated throughout the stations as well as in the subway proper to provide the greatest possible safety and convenience for the traveling public. Each station has a mezzanine in the space between the subway roof and the street level. Facilities for collecting fares and for providing service to the general public are installed on these mezzanine floors. The general plan of each downtown station provides for four stairway entrances from the sidewalk area of State St. leading to the mezzanine floor located 18 ft. below. An escalator and stairway on each side of the mezzanine give access to the loading platform below. Escalators operate at 90 ft. per min. and they are reversible. An illuminated directional marker indicates their direction of travel. In general, duplicate fare-collecting facilities are to be found in the mezzanines. They include 2 cashier-controlled and 2 coin-operated entrance turnstiles, 4 exit turnstiles and 2 emergency gates on each side of the station. Coin-operated lockers built into the walls, open telephone booths lined with acoustic metal, a general facilities room, a concessions booth and rest rooms complete the facilities of the mezzanines.

One of the several modern conveniences to be noted is the color schemes adopted for the different station platforms to aid the commuter in identifying his destination. Four basic colors—blue, red, green and brown—are rotated in the order named and used in the directional signs, steel columns and terra cotta trim. Platforms and mezzanine floors are of red concrete. An artificially prepared corundum was added to the concrete in the floors and platforms to provide a non-slip surface. Stair treads are fitted with abrasive tile embedded in the finish to prevent slipping. Two lines of tile extend across in front of the bottom stair tread for safety.

Despite the necessity for substituting non-critical materials for critical items wherever possible, the mezzanines were designed to include attractive features while at the same time providing resistance to wear and tear during the long life of the structure. Exposed sidewalls of the entrance stairs from the street sidewalk area are faced with tan glazed tile; light gray tile lines the interior passageways; gray structural glass ¾-in. thick and mounted on concrete blocks forms the interior walls of the mezzanine; and exposed steel columns in the mezzanine area are encased in concrete and finished with radio-black marble. This same type of marble lines the stairway wells leading to the loading platforms. Platform roof arches and mezzanine ceilings are painted a light-reflecting color. Fluorescent lighting is used throughout both the mezzanine and loading platform areas, augmented by incandescent lights for emergency use.

Transfer from the State Street subway to the Dearborn Street line is by passageways connecting the mezzanine stations of the two lines at the

kson and Washington Street sta-
ns. Also connecting the two sys-
ns are two transfer passageways
cated below the tubes. These permit
nsferring between the two routes
thout the necessity of ascending to
mezzanine floors. Within the
wntown section of the subway there
ll be 10 entrances from the mez-
nines directly into adjoining de-
rtment stores. Completion of some
s been delayed due to the war.

This subway is virtually free from
exposed electrical wiring. The
430-ft. continuous loading platform
the downtown area also serves as
duct bench enclosing the electrical
es. Power for the subway trains is
e same as that used on the elevated
stem, that is, 600-v. direct current
the contact rails with paralleling
eders and with a return to the sub-
tions through running rails. The
ntact (or third) rail weighs 144 lb.
r yd. This heavy steel rail was used
reduce the amount of copper re-
ired for the parallel feeders. Con-
t shoes on the trains are of the
spended overrunning type. Contact
ils are supported on porcelain in-
lators with provisions made for con-
action and expansion at 1,000-ft. in-
rvals.

In addition to the duplicate
c. sources for the regular fluorescent
hting system, a separate limited
hting system is fed from the 600 v.,
c. traction power system through a
hting main running the entire
ngth of one tube. Should a power
ilure occur in both of these systems,
tomatic transfer switches will tap
wer from the third rail to light a
all number of lamps, sufficient for
ergency operation of the subway.
Contact rails are sectionalized at
bstation feed points, interlocking
nts and various other locations.
ergency alarm boxes are mounted
the subway walls at intervals of
out 400 ft. along each track. In the
ent of an emergency such as a fire
train wreck the motorman of an
fected train, or other employee, can
ow a switch on the alarm box
reby de-energizing the contact rail
d at the same time give warning
the power supervisor's office. An-
her safety feature provided is the
nstruction of a continuous emer-
ncy walkway built along the tube
lls at car platform height. Emer-
ncy circular stairwells at frequent
tervals throughout the system lead
exits at the sidewalk level. Covers on these exits are equipped with panic-hardware to insure positive operation.

The signal system for train operation includes wayside colored lights, approach interlocking signals and other automatically controlled safety signals found only in the most modern railway systems. One of the greatest safety features in train operation to be found in the subway is the system of electro-pneumatic train-stop mechanisms located at each automatic block, approach and home signal. In the event any train should pass a red light at one of these points, this train-stop mechanism engages trip arms on the train, instantly setting its air brakes. Forward movement of the train then is accomplished only after the motorman manipulates a stop-release mounted near the signal light. Compressed air for operating the automatic train stops and track switches at interlocking plants is delivered throughout the subway in 1½-in. pipe under a pressure of 65 lb. per sq. in.

Piston action ventilation

Contrary to common belief, ventilation of the subway is required primarily for the disposal of excess heat generated by the trains and other electrically operated equipment, rather than for supplying necessary fresh air to the subway patrons. Since the subway has single track tubes and the cross-sectional area of the trains is about one-half that of the tubes, the positive piston action of a moving train draws large quantities of outside air in through vent shafts and at the same time forces an equal amount of air out through similar vertical shafts extending from the tubes to outlets at the sidewalk level. There are, in all, 69 of these shafts throughout the State Street subway. Vent shafts near the stations serve the double purpose of ventilation and blast relief for the station platform from the air pressure of an oncoming train. Supplementing the piston-action scheme of ventilation are several powerful electrically operated ventilating fans in the downtown station area and throughout the subway tubes. Electrically operated louvers at certain ventilating ducts control the movement of the air during normal operations and provide for quick and positive elimination of smoke during an emergency.

Priority restrictions on metal prevented the securing of modern trains for operation in the subway, thereby necessitating the use of existing steel cars of the Chicago Rapid Transit Company. There is a total of 455 of these units available—389 of which are equipped with the two 170-hp. motors each—and 66 trailers. They have a seating capacity of 52 passengers per car with a total capacity of 100. These rapid-transit cars are well adapted for use in the subway as they were designed originally for such service. Utilizing all 455 of these steel cars in the subway will provide three-minute service in each direction.

Designed for pleasant riders

The modernly designed roadbed of the subway provides pleasant riding. Alignment curves of large radii produce negligible lurching effect at high speeds while running rails supported on resilient pads atop the red oak ties embedded in the concrete floor of the tubes absorb most of the trains vibrations while in transit.

On October 1, a new transfer system was inaugurated between the Chicago Surface Lines, the Rapid Transit Co. including the subway and the Chicago Motor Coach Co. For a 10-cent fare a passenger may secure a transfer from any one of the three companies' lines to the lines of either of the other two. He may also retransfer once to the original line providing he continues to travel in the same general direction. Present negotiations by the city contemplate unification of these transportation companies into a single new company for operating all of the transit lines. Such a move will achieve substantial savings in operation costs and service will be improved further by integrating all facilities of the present transit companies under a single system.

The State Street subway as well as the completed portion of the Dearborn Street route were designed and built by the city of Chicago, Department of Subways and Superhighways, with the cooperation of the Public Works Administration. Representing the city are: Philip Harrington, commissioner; Ralph H. Burke and Charles E. DeLeuw, chief engineers; Peter F. Girard, assistant chief engineer; H. C. Johnsen, engineer of design; V. E. Gunlock, engineer of construction and R. S. Knapp, engineer of surveys. Joshua D'Esposito is project engineer and U. F. Turpin, asst. project engineer for the Public Works Administration.

Dismantling Tacoma Narrows Bridge Towers

Chas. E. Andrews
Chief Consulting Engineer, Washington Toll Bridge Authority.

***Contents in Brief**—After cables had been taken down, the heavy steel sections of the tower themselves were dismantled in the reverse order of assembly by "busting out" the rivets of the field joints and lifting down shop-fabricated sections, weighing as much as 30 tons, with two Chicago booms placed so that they could move one another.*

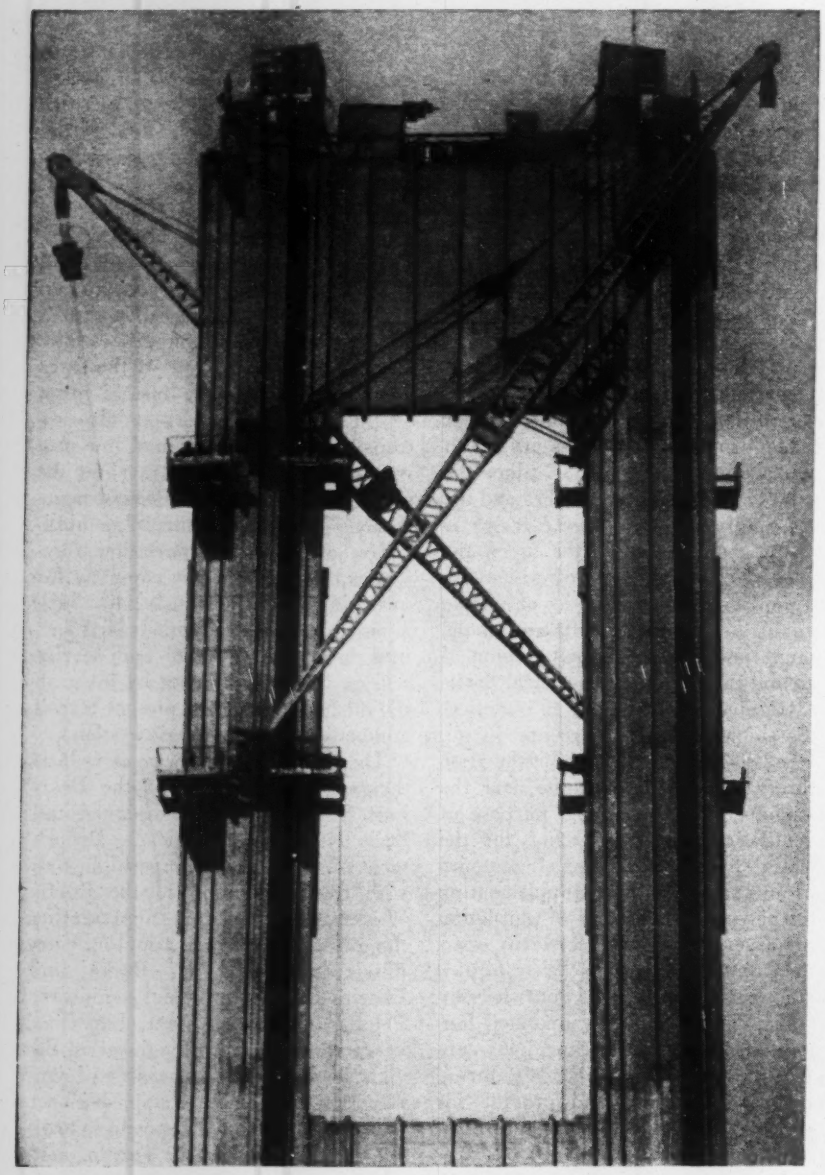


Fig. 1. In the highest position, as here shown, the booms removed cable saddles first, then the first tower lift and the top strut.

DISMANTLING THE STEEL TOWERS of Tacoma Narrows Bridge could not be started until after the cables were down and out of the way (*ENR* Aug. 26, 1943, p. 347). However, while the cables were being dismantled a considerable amount of preparatory work in the manufacture of equipment, placing of hoisting engines and construction of protective sheds was carried on. There was about 1,900 tons of steel in each tower. Operations were started on the southerly or Tacoma tower first and then the equipment was moved to the opposite tower where the same procedure was repeated. Dismantling of the first tower started March 15 and was completed May 11, 1943, at the rate of about 235 tons per week.

By reason of the nation-wide equipment shortage it was impossible to rent or purchase booms of sufficient capacity to handle the large shop-fabricated sections. As it was not considered economical to dismember these sections while still in place on the tower, the design department of the Toll Bridge Authority undertook to design booms that could be built from available material.

The design was predicated on the requirement that each boom should be able to pick up a load of 50 tons at full radius (110 ft.) and deposit this load on a barge alongside the pier. The booms were made of the conventional tapered section with a central portion 20 ft. long of uniform cross-section, thus making it possible, by taking out bolted-up sections, to make the total length either 90, 100 or 110 ft. With the exception of these bolted connections the booms were largely of welded construction. In the center section the dimensions, from back to back of angles, were 3 ft. on the horizontal and $3\frac{1}{2}$ ft. on the vertical.

One boom was attached to the outstanding cell on the channel side and the other to the outstanding cell on the shore side of the tower, the tower itself being used as a mast. As the

verage vertical length of tower sections was 40 ft., the mast height was limited to this distance. This short mast height caused high stresses in the rope system. These were taken into account in the design of boom seats and topping lift connections to the tower which were made by means of brackets. The brackets, in turn, were bolted to the tower through holes from which rivets had been removed. Load line and topping lift consisted of nine parts of $\frac{7}{8}$-in. steel wire rope.

The swinging mechanism consisted of steel outriggers attached to the foot disk and operated through lines to the hoist. Special care was taken to provide sufficient bearing area in the boom seat to insure proper lubrication and ease of swing. Power for hoisting was supplied by electric units with 175 and 225-hp. motors.

The successive steps in tower removal were (1) to provide means of making connections to the towers by removing a sufficient number of rivets, (2) to hoist one of the booms to the highest position on the tower by means of rigging attached to the top of the tower expressly for this purpose, (3) with the first boom in place, it was used to hoist the second boom and to hold it while connections were completed, (4) after the steel sections had been removed down to the top of the masts, one of the booms would lower the other rig to the next lower position. When it was there set in place it, in turn, would lower the first rig to the same level

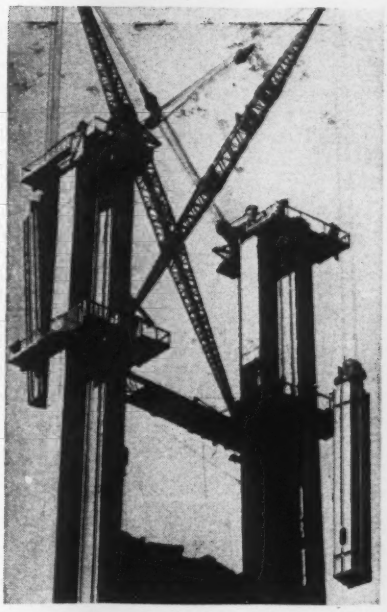


Fig. 2. Lowering two sections at once speeded up operations.

and the removal of tower sections would then proceed. This process was repeated until all but a section of one leg remained. This section was taken off by a floating derrick.

Practically all of the sections were released by the removal of field rivets. Some difficulty in rivet removal was due to offset rivets which could not easily be backed out of holes that had been reamed in the field. (This last point puts emphasis on the need for greater care in shop assembly of bridge tower sections.) Practically all of the rivets were "busted," using either specially constructed heavy rivet busters or No. 81X rivet guns. All tower rivets were 1 in. dia.

In the heavier sections, which ranged up to 30 tons in weight, it was considered expedient to start the lift with jacks rather than to attempt to break the sections free with direct lift by the boom.

Dismantling equipment was moved to the second pier on May 18. By this time the setting up and operation of the boom rigs was so well in hand that on the same day the rigs were moved, one of the cable saddles was lowered. Actual steel removal was completed in thirty days, a rate of 450 tons per week.

In general the method chosen for tower dismantling was entirely satisfactory. Factors contributing to speedier dismantling of the second tower were that (1) the tidal currents there are not nearly so swift, which materially facilitated the loading of barges and (2) weather conditions were better.

As to discovery of any evidences of strain, suffered during the sway of the towers at the time of the collapse, it should be said that in addition to the buckled plates on the compression side of the towers (as they were bent shoreward) rivets on the tension side showed partial failure in shear, and there was partial failure in the edge distance of the plates.

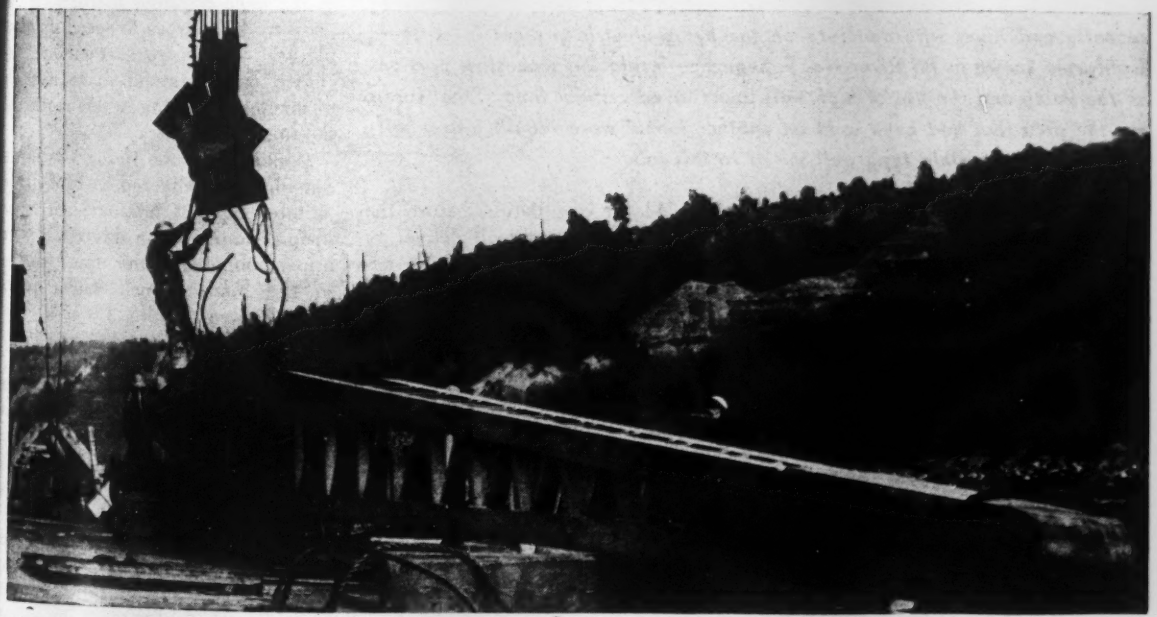


Fig. 3. This job-made boom, with length adjustable, 90 to 110 ft., was designed to handle 50-ton loads at 110-ft. radius.

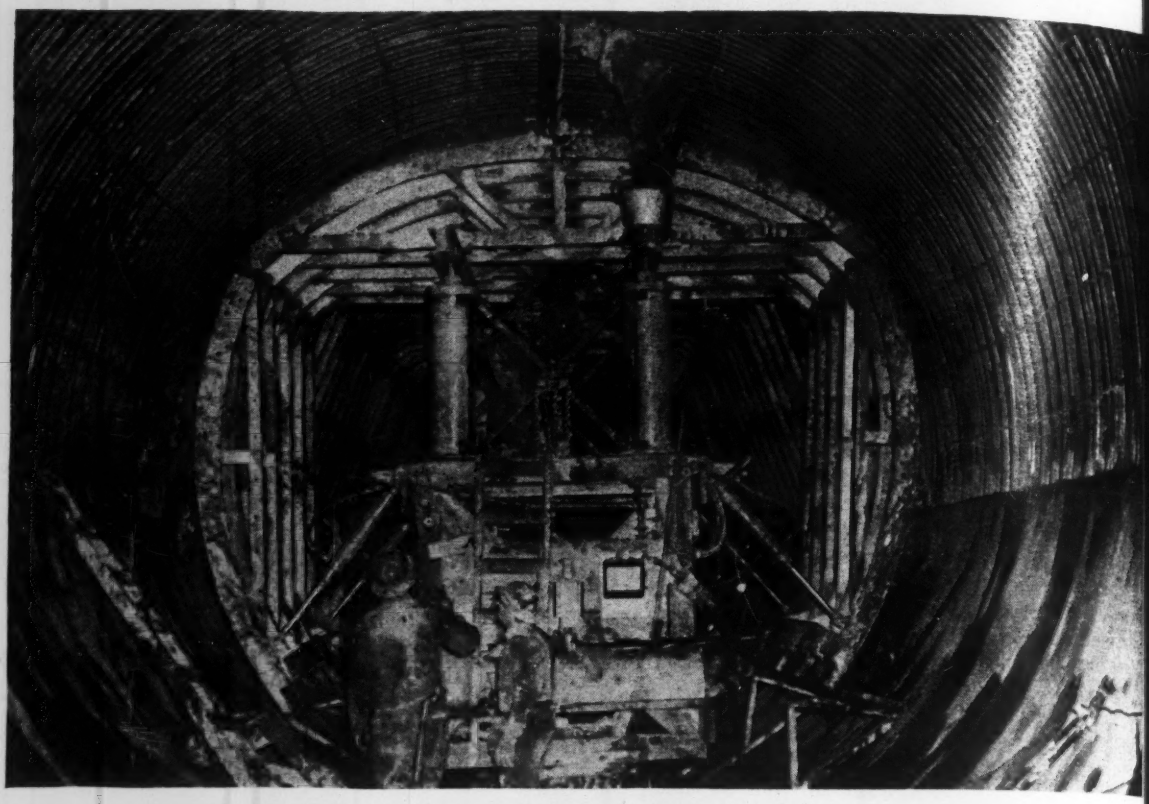


Fig. 1. Collapsible lining forms are here being moved in a circular tunnel section.

Placing Concrete Lining in a 19-Ft. Tunnel

***Contents in Brief**—Some 28,000 ft. of tunnel, 19 ft. in diameter, was driven recently and lined with concrete on the hydro-electric project in northern California known as Pit River No. 5. Sequence in placing successive portions of the lining and the use of high wall pours saved critical time. Steel forms for the arch that had been used on another tunnel were rebuilt into a self-supporting collapsible type well suited to this job.*

CONCRETE LINING in the Pacific Gas and Electric Co.'s recently completed 28,200-ft. Pit River No. 5 hydro-electric tunnel was placed by methods of handling forms and delivering concrete that embody the result of long experience in construction of large-diameter tunnels. Scarcity of critical materials made it worth while to adapt old steel forms for the arch to the needs of this job. Successive stages of the lining operation were arranged so that a minimum of concrete yardage would be required in the final or arch pour, which was the anticipated bottleneck in the matter of time required for completion of the tunnel. As the Pit 5 project is scheduled for completion before the end of this year and will deliver to the company's power network an additional 160,000 kva., it was regarded as a contribution to the war effort to make all possible speed in construction operations.

The tunnel is divided into two unequal parts by an open channel section in which the flow is controlled by a levee on the lower side. Above the open channel is the 5,050-ft. length of "upper tunnel" in which there is one adit. Below is the 23,150-ft. "main tunnel" tapped by three adits and involving one 13,012-ft. length between adits. This longer tunnel section also was a major item in the time required to complete the project. Endeavors to speed up completion of the work, therefore, included careful attention to methods of placing the lining in this portion of the tunnel.

Concrete for the lining was mixed outside and delivered in cars of the agitator type. A mixing plant in the open conduit section served the entire upper tunnel and the upper portion of the main tunnel. Other plants were located at adits 3 and 4.

Sequence in lining operations

About half the total length of the tunnel, in which the governing factor was resistance to internal pressure, has a circular section of 19-ft. inside diameter. The other half has a 19x19-ft. unreinforced horseshoe section whose design was influenced mainly by the stable ground existing in the downstream portion of tunnel. The downstream half of the tunnel, in the more stable formation, used

timbering of 12x12s on 3 to 5-ft. centers, as conditions required. Overhead lagging was used throughout and some lagging went in on the sides. Most of the overhead lagging was removed just prior to lining to permit actual contact of the concrete with undisturbed ground.

The upstream half of the length, in less stable ground, required 12x12-in. double sets at 18-in. centers in some spots and 12x12s at 3-ft. centers elsewhere. Top and sides were all lagged and considerable blocking was required to catch up over the excavated section.

Except where removable lagging permitted contact between concrete and ground, the circular section was reinforced with hoops of 1 and 1¼-in. square bars and longitudinal ⅝-in. bars. Two lapped, semicircular sections made up the hoops. Minimum hoop steel was governed by the amount required to take internal hydrostatic loads.

Side forms were filled to best advantage with the aid of a transverse conveyor (Fig. 2) supplied from a longitudinal conveyor fed from the gravity hopper. Curbs and invert were placed with chutes from the end of the longitudinal conveyor. Arch forms were filled by the concrete gun operated by pneumatic pressure, which backed away pulling its delivery pipe with it as the arch was completed. Sequence of the pouring in circular and horseshoe sections is indicated in Fig. 3.

Fig. 2. Delivery of concrete to either side was made possible by a transverse belt, arranged to rotate about a central shaft.

In both the circular and horseshoe, the walls were brought up by the gravity pours to a level such that the arch pour includes only a semicircle. This plan was chosen because of several advantages: (1) The same forms could be used for the arch in both sections, (2) a lesser amount of concrete yardage was required per linear foot of arch pour and (3) with these advantages a time saving of about 6 weeks was effected in ultimate completion of the job. Tunnel driving and concreting of wall sections were carried on simultaneously, leaving only the concrete of the arch to be placed after the driving was completed. Therefore, any time savings resultant from a decrease in yardage in the arch pour could be credited as net gain in critical times.

From a previous tunnel lining job the power company had an ample supply of steel forms that fitted a 9½-ft. radius. These old forms had been held in place by means of wedge jumbos and, hence, were not braced to be completely self-supporting. However, by use of scrap transmission tower steel which the company had on hand, it was possible to work over the forms in the welding shop, converting them into the collapsible self-supporting type shown in Fig. 3. Two existing 10-ft. sections of arch form were used to make one 20-ft.

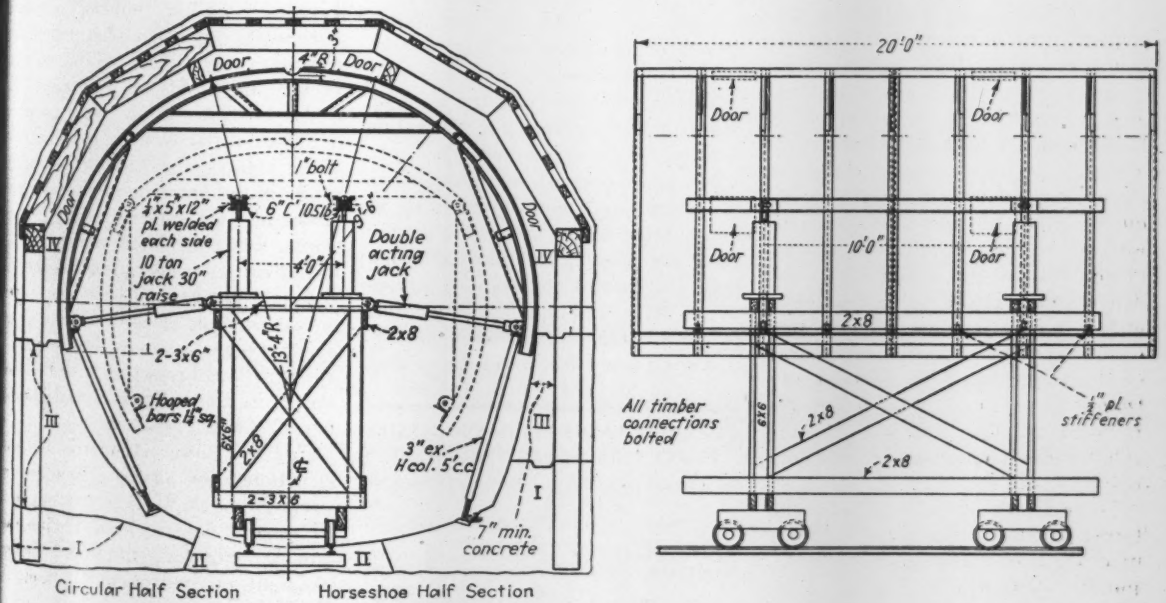


Fig. 3. Sequence of the four pours in circular and horseshoe sections of the tunnel, also details of rebuilt arch forms.

section which was supported on hydraulic jacks on a 20-ft. car.

This car, unlike a staging support, was used merely for advancing the forms from setting to setting. The self-supporting design, with heavy trench jacks extending from the steel form down to notches in the concrete spaced 5 ft. apart, made it possible to remove the transfer car as soon as the 20-ft. section of form was set. Thus the car could take forms that were collapsed at one end of the set and move them up into position for the next advance, passing, en route, beneath forms in service. In this way continuous operations were possible because advancing the forms did not interrupt or in any way interfere with pneumatic-placing equipment. Average rates of arch pours were 150 to 200 lin.ft. for three 8-hr. shifts. The usual time for leaving forms in place was from 10 to 12 hr. An ample supply of arched forms was kept on hand for operation on this basis.

Concrete delivery equipment

Bulk cement came to the job in tank trucks of two types, one of the dump-delivery type and the other using cylindrical bottom-dump steel tanks hauled on the flat beds of truck and trailer. The steel tanks were lifted by derrick from truck to silo. From the silos, delivery was by gravity to small tank trucks which supplied three central mixing plants (one of 1-cu.yd. and two of 2-cu.yd. capacity) strategically located for delivery to the several adits and portals.

From the concrete plants, mixed concrete was delivered in 4½-cu.yd. drums of the revolving agitator type mounted on railroad trucks of 3-ft. gage, to that part of the tunnel where lining was being placed. The maximum haul of fresh concrete was about 1½ mi. and this maximum run required 20 to 30 min. The concrete was freshly mixed when it started out on this haul and as soon as the delivery car arrived at destination a motor on the revolving drum was connected with a convenient source of electrical energy by the conveyor tender, and the mixing operation was resumed. Mixing continued while the agitator discharged onto a belt conveyor.

For delivery of concrete into wall forms, a 24-in. transverse belt was used which was mounted on a central spindle, as shown in Fig. 2. After filling the wall form on one side it could be rotated 180 deg. on its vertical shaft and made to deliver to the form of the opposite wall.

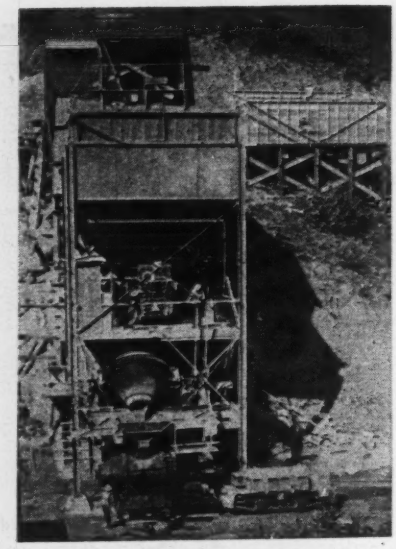


Fig. 4. Concrete mixing plant at an adit portal loads agitator-type car.

When concrete had set and forms were stripped from the lower half of the barrel, arch forms could be placed, ready for the pneumatic gun with its 80-ft. length of 6-in. delivery pipe. The delivery pipe was rested in a small groove at the crown of the arch and was continually being pulled backward as the gun backed away from its work. After elapse of the required time for setting, form sections were removed and were set in place closer to the gun. With an 80-ft. length of delivery pipe ten to twelve of the 20-ft. form sections were enough to provide for continuous arch pouring in one heading.

The longitudinal conveyor was used to deliver concrete from the agitator drum to the concrete gun. For this purpose the conveyor discharged into a 2-cu.yd. hopper whose function was to receive any concrete remaining in the agitator or on the belt after the gun was loaded, thereby avoiding need for careful control of the conveyor drive and making it possible to release the agitator immediately.

An improved feature of the gate on the gun was an "air jam" control which effected airtight closure with great speed. This gate carried a small hopper so mounted that when the gate was open the hopper was in position for guiding concrete to the gun from the storage hopper above.

Doors in the steel arch forms permitted access of workmen into the space to be filled with concrete up to the time the pour approached the location of the door. Inspectors were constantly observing the condition of the advancing concrete pour and the operation of external and internal type vibrators. This work was directed toward obviating any risk of rock pockets and securing a smooth inner face of the concrete. In the arch forms the angle of repose of the advancing flow of concrete was about 1 on 4 or 1 on 5.

For the concrete to be put through the pneumatic gun, aggregate with a maximum size of 1½ in. was used. For the remainder of the lining, aggregate ranging up to 2½ in. was permitted. The washed and crushed gravel used for aggregate on this job made it possible to mix concrete with 5½ to 6½ sacks of cement per cu.yd. that gave compressive strength of 3,000 lb. in 28 days. Placement in the crown of the arch, where there would have to be considerable reliance on gravity flow, made it necessary to use a fairly wet mix. Usually the slump was at least 6 in. in arch concrete. The concrete yardages given in the accompanying table refer to averages to the clearance line at the back of the 12-in. timbers, including overbreak. Specifications called for a minimum thickness of 7 in. of concrete lining inside all timbering.

All of the lining was pressure grouted. A fairly high pressure was used behind the circular sections, while in the horseshoe sections a low pressure, just sufficient to fill open voids, was considered sufficient.

Construction operations on the Pit 5 tunnel are being carried on under a combination of contract and force account plans, whereby the company's construction forces join with those of the T. E. Connolly, Inc. and Hanrahan Co., San Francisco.

For the power company the construction work on Pit 5 is under supervision of O. W. Peterson, engineer of general construction, Pacific Gas and Electric Co., and his principal assistant on hydro construction, H. W. Haberkorn.

CONCRETE YARDAGES IN SUCCESSIVE POURS (SEE FIG. 3) PER LIN. FT.

Circular Section	(Cu. yd.)	Horseshoe Section	(Cu. yd.)
Pour 1 (curb)	0.8	Pour 1 (curb)	1.2
Pour 2 (invert)	0.5	Pour 2 (invert)	0.7
Pour 3 (walls)	1.8	Pour 3 (walls)	1.1
Pour 4 (arch)	2.2	Pour 4 (arch)	3.5
Total	5.3	Total	6.5

SPECIAL SECTION ON *Buildings* AT HOME AND ABROAD

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Photo: Courtesy The Austin Co.

ENGINEERING ABROAD — AS SEEN BY ENR EDITORS

Military Huts and Structures At American Installations in Britain

Waldo G. Bowman
Editor, Engineering News-Record
(Airmail from European Theatre of Operations)

***Contents in Brief**—British designs are used for all structures at American camps, depots, hospitals and airfields in Great Britain. Arched buildings of corrugated steel or cement-asbestos are most used, but a precast concrete frame with hip roof and brick, tile or concrete curtain walls is appearing more frequently. Wood structures are noticeably absent. Numerous building designs have been tried. Experiments are underway on a self-supporting arch of concrete plastered against a backing of burlap. Bolted flat-bottom steel tanks on steel towers, brick sewage plant structures and steel rigid-frame hangars are standard.*

ANY RESEMBLANCE between the structures at American military installations in Great Britain and those at training camps, depots and airfields in the United States is purely coincidental. The result is that the American soldier entering the European Theatre of Operations will be surprised by the structures that have been built for his use. Many of them are totally unfamiliar, and most are of what he would rate as permanent rather than temporary construction. Likely as not he will find many of them being built by American Engineer troops.

Singular as this state of affairs may appear to new arrivals, American Army Engineers have a logical explanation for it. The structures are all of British design, because they are for the British, and we are merely going to use them. They appear to be of permanent construction only because they are built of the most plentiful materials in Great Britain—brick, concrete, asbestos-cement and steel. And some of them are being built by Engineer troops to speed up the program, and to give the troops valuable construction training and experience, as well as familiarity with these new types of structures. Because a similar degree of familiarity may be valuable for engineers in the United States, this article is devoted to a presentation of a number of the more frequently used designs.

Most of the buildings, that is, the huts as distinguished from the hangars and the special structures, have name designations. Thus, there is the

Fig. 1. Erecting the steel ribs for a group of Romney huts at a U. S. depot in the European Theatre of Operations.

Fig. 2. Army Engineer troops from the United States immediately proved their capabilities as steel erectors, but had more difficulty in building a good brick wall in the ends of the Nissen huts.

familiar Nissen hut, as well as the Romney and Hall huts; and there is one known simply as the circular asbestos hut, and another of experimental type, which goes by the unusual name of C'tesiphon. Seco huts, a timber frame with plywood panels, were once widely used, but the materials are no longer available. Marston shedding is a rectangular cross-section warehouse building and there are several precast concrete hut designs, the two most frequently used being the B.C.F. (British Concrete Federation) and the standard M.O.W. (Ministry of Works). An arched corrugated iron hangar is known as the "blister," while another of rigid frame type is referred to merely as the T-2. The other structures, such as water tanks, have acquired no special names.

Nissen huts

The "work horse" structure of the military camp is the Nissen hut, more generally known in the United States now as the Quonset hut. American camps in Britain use it in 16 and 24-ft. spans and in lengths from 36 to 72 ft. for living quarters, mess halls, hospitals, administration buildings and bath houses. It is held to be the most easily erected and highly adaptable of all types of hut, one advantage being that a foundation is not absolutely necessary.

The frame of the Nissen consists of light steel tee ribs curved to an inside radius of 8 ft. and spaced 6 ft. apart by five lines of timber purlins which support the outer shell of corrugated steel sheets (through lag screws) and the inner lining (when used) of composition boards or corrugated steel sheets. The ribs come in three sections requiring two bolted field splices, and are of such length for the 16-ft. span hut as to give a 10-ft. ceiling height at the center; as a consequence of this height and a radius of only 8 ft., the cross section of a 16-ft. span Nissen hut is more than a semicircle, which is one of its distinguishing characteristics. The 24-ft. span hut has a 12-ft. center height and is thus a true semicircle.

As built in the European Theatre of Operations, Nissen huts are provided with 4-in. concrete slab floors to which the timber wall plates that carry the ends of the ribs are bolted. The ends of the huts and the partitions, if any, are of brick, precast concrete panels or tile, but almost never of wood. Window frames and casements are also more apt to be steel than wood; if windows are used in the side walls, they are set in dormers, but they may also be installed in the end walls. Additional ventilation is often provided by timber or steel louvres over the door or merely by leaving out several bricks in alternate courses in the same location.

Fig. 3. Precast concrete wall panels and window and door frames enclose the ends of many Nissen huts.

That a Nissen hut can be made into a comfortable and attractive structure is illustrated by the accompanying interior view of an Engineer camp hospital. A basic reason for the neat appearance is an ingenious device in the form of taut circumferential wires that is used to hold the lining sheets tightly against the inside of the flange of the tee rib. When used with composition board lining, as shown in another illustration (Fig. 4), these wires carry battens which aid in holding the lining snug.

Romney huts

When longer span huts are required, as for warehouses or recreation buildings a heavier framing than can be supplied by the Nissen hut is necessary, a fact which was demonstrated by the unsuccessful attempt to use a 35-ft. span Nissen-form hut called the Iris. Now, for 35-ft. spans the Romney semi-circular hut is standard. Normally built in a 96-ft. length, it is framed with 2½-in. dia., 8-ga. tubular ribs spaced 8 ft. on centers by steel angle purlins. Each rib is in four sections, equipped with 6½-in. dia. flanged ends for bolted field splices and for bolting to the concrete floor. Plates, shop-welded at right angles to the top of the ribs, furnish two-bolt connections for the end of each purlin. The resulting framework is unusually rigid.

The external covering of the Romney hut is corrugated steel sheeting attached to the purlins by ¼-in. hook

Fig. 4. Army Engineer troops erect a Nissen hut at a U. S. camp in the European Theatre of Operations. Note the circumferential wires and horizontal battens that hold the composition board lining against the steel ribs.

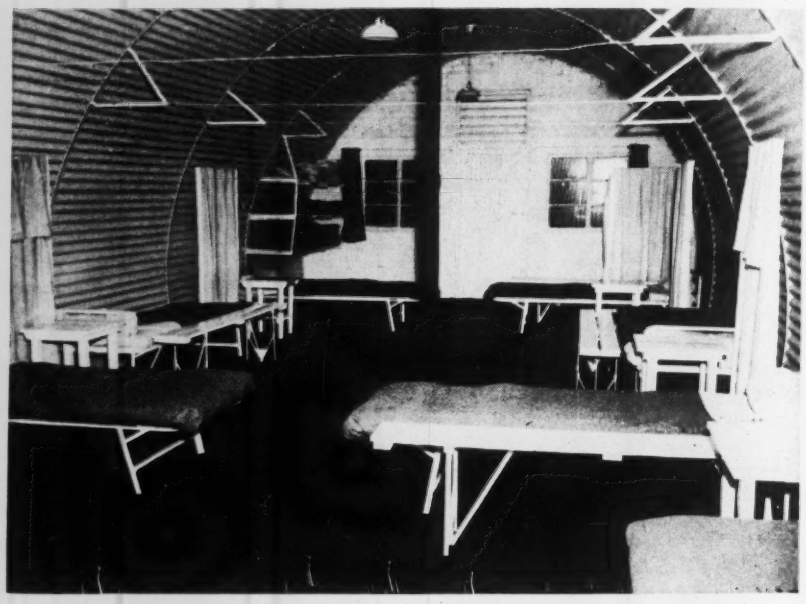


Fig. 5. Nissen hut hospital at an Army Engineer camp. Note how the ribs afford means for attaching shelves and accessories.

bolts. No internal covering is used. Natural lighting is provided by wired-glass windows set flush in the sheeting. End walls may be of brick, concrete panels or corrugated sheeting. Because large sliding doors are often used, end walls are most frequently of corrugated sheeting supported by tubular studs. A depot made up of long lines of Romney huts with railroad tracks along one end and a highway along the other is an imposing installation.

For warehouse requirements that the Romney hut cannot fulfill, buildings known as Marston shedding are used. They have a conventional steel frame of columns and 45-ft. span roof trusses. Their ceiling height is greater than that of the Romney, and they also permit installation of an overhead crane if desired.

Asbestos arch hut

An arched hut frequently used is composed of curved asbestos-cement corrugated sheets. As compared with the Nissen and Romney hut it has both advantages and disadvantages. On the credit side is the fact that no framing is required, the asbestos-cement sheets being self-supporting, but against this must be set the brittleness of the material, which leads to breakage during erection and makes it impossible to attach brackets or other useful accessories on the inside.

These huts are of 18-ft. span, 10½ ft. high in the center and usually 36 ft. long. The foundations consist of 12-in. high brick walls topped by a precast concrete sill containing a channel, into which the ends of the asbestos-cement sheets are inserted to counter their arch thrust. Because this channel collects dirt and water, an alternate sill design, involving an L-shaped beam to which the sheets are fastened by hook bolts, is also sometimes used.

The asbestos-cement sheets have deep corrugations, which are 6 in. apart center to center, and the huts are unusually sturdy. Brick or tile walls in the ends contribute to the rigidity of the structure as a whole. Since it is not practicable to provide windows or roof ventilators in the shells of these huts, both windows and louvres are used in the end walls. Precast concrete window and door-frames are characteristic.

Precast concrete huts

It is because of the necessity to conserve steel that the cement-asbestos hut is used, and it is for the same reason that several types of precast concrete buildings have been tried. Even before the war, British concrete products manufacturers had shown much more interest in precast building framing than had similar companies in the United States, and a number of promising designs were on the market. One of these that was adapted for military camp buildings is the B.C.F., a designation taken from the initials of the manufacturer, the British Concrete Federation.

The B.C.F. hut has an 18-ft. 6-in. span and, as shown in one of the illustrations on the next page, is framed with precast columns and beams. The columns have an I-section, which provides a slot for the insertion of wall panels, and are haunched both ways at the top to furnish a substantial seat for the beams, which are doweled to them. The beams simulate plate girders, having thick flanges and a thin web cast with integral vertical stiffeners. A thickened section is also provided at the ends and at the center where a field splice occurs. This splice is one of the interesting details

of the design, the top or compression flanges abutting on a piece of pipe around which jute is wrappered to form a cushion, while the bottom flange tension splice is made by a threaded bolt which connects the reinforcing steel in the two halves of the beam; the steel rods project from the ends of the beam halves and are looped back into the concrete to provide for the attachment of this splicing bolt.

The frames formed by these columns and beams are set on about 3½-ft. centers, so that precast enclosure panels are readily set between them. In the walls, both exterior and interior panels are used, those outside being of concrete about 1 in. thick, while the lining is of course cinder concrete about 2 in. thick. These latter type panels, known as "breeze" blocks, are also used for the roof, which is covered with asphalt felt roofing.

Windows are readily provided in the walls, and when the interior is plastered these huts are well lighted and attractive. They have, however, several disadvantages which have militated against their extensive use. The members are heavy, a half of a roof beam, for example, weighing about 300 lb. Care must be exercised in handling them for they break easily, not only when dropped, but when tightening the bolt at the splices. Also, the headroom provided is only 7½ ft., and for some military purposes this has not been deemed sufficient.

The most successful precast concrete frame hut, judging from its wide and growing use, is the so-called standard M.O.W. (Ministry of Works) design. Originally developed so that a variety of different materials could be used for the wall and roof units, practice has generally settled on panels of wood and composition board or else the use of brick (or tile) walls in combination with corrugated cement-asbestos sheets on the roof. The buildings are of hip roof type, 7½ ft. high at the eaves and 11½ ft. at the ridge. The clear span is 18½ ft., and standard lengths are 30 ft. (5 bays) and 60 ft. (10 bays).

The frame of the M.O.W. hut consists of precast concrete columns and rafters, sills and lintels, while purlins are 3 x 1½-in. lumber, as shown in the accompanying drawing. Columns are of two types, those at the corners being roughly L shaped so as to provide bearing seats for the lintels that intersect at right angles at these points, while those in the walls are T-shaped and incorporate a relatively long haunch at the top to which the rafters are connected by bolts. These rafters, rectanglar sections 4½ x 7½ in., contain plugs in their side faces to which nailing strips for supporting the purlins are attached, and at the ridge joint are connected by a pin, to the ends of which are screwed pieces of tubing that serve as a ridge pole. The sills are really spacers that fit between the columns at floor level and do not support the columns, whose bases are grouted into holes in the floor slab to provide the necessary fixity. The lintels rest on top of the columns, to which they are attached by metal dowels. Both sills and lintels are cast with channels into which the wall materials are fitted.

The two types of wall construction are illustrated in the drawing on the next page, which shows how they butt against the inside of the column flanges. The composition board panels, covered on the outside with waterproof roofing felt, are secured to the columns by means of wood nailing strips while the brick or tile is self-supporting. The drawing also illustrates the two types of roof construction, and when cement-asbestos sheets are used it will be noted that an inner composition board lining is also in-

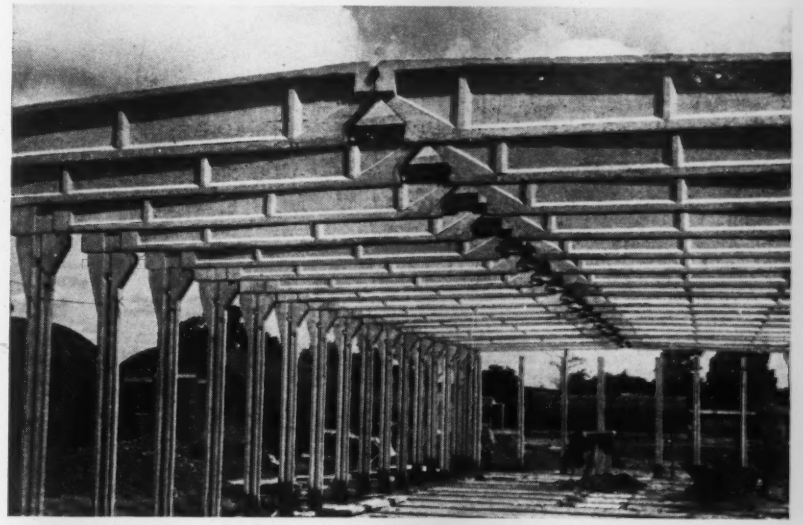


Fig. 6. Precast concrete hut of B.C.F. design. Beams come in halves and reinforcing steel is spliced by inserting a nut and bolt detail.

Fig. 7. Precast concrete hut of M.O.W. design is most widely used next to steel Nissen. Composition board wall panels enclose this particular hut.

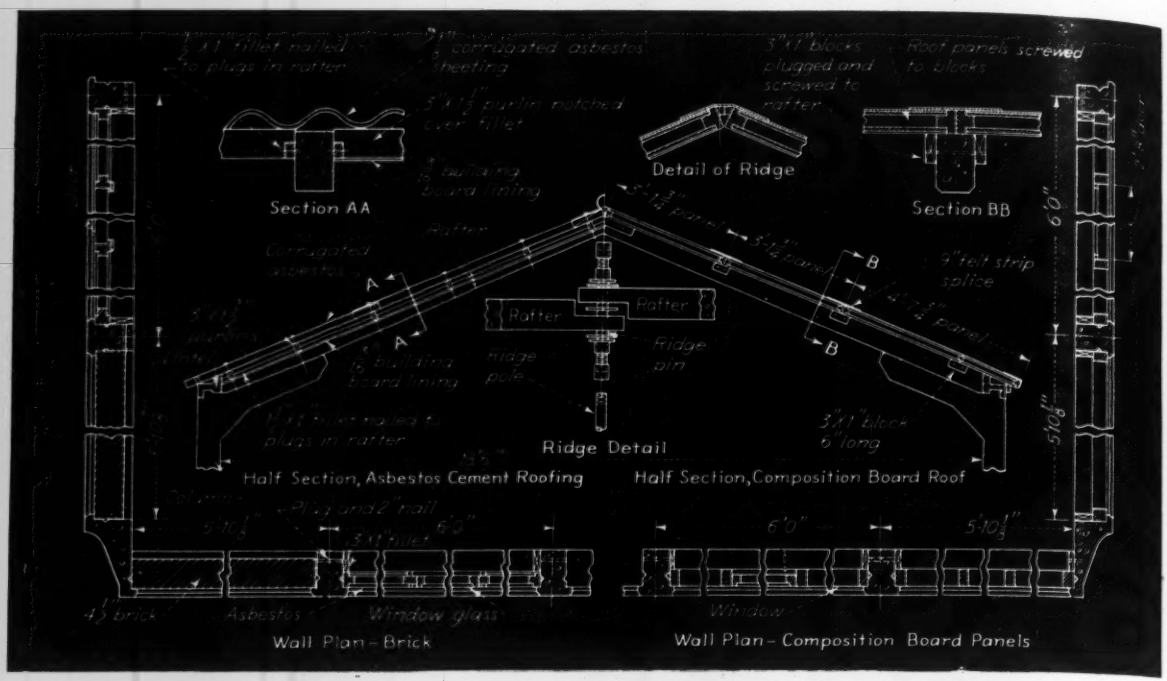


Fig. 8. Structural details of M.O.W. precast concrete hut designed to utilize various types of enclosure materials.

stalled. Steel casement windows are the general rule.

There is also a 24-ft. span M.O.W. hut which is frequently used for hospitals. In it, the columns are straight, and the haunch, in a pierced design, is made a part of the rafter.

A timber hut

Despite the fact that the use of timber in Britain has practically ceased, a few timber huts are being built at American camps and by American troops. These are of the so-called Hall type and are in fact the pattern upon which the M.O.W. precast concrete hut was based. Thus, they have a span of 18½ ft., are usually 60 ft. long, are enclosed by composition board panels in walls and roof, and use a hip roof with 7½ ft. clearance at the eaves and 11½ ft. at the ridge. They differ from the M.O.W. composition-board-enclosed hut only in that their frame is of wood. It is not proper to call it "timber" because the columns and the members of the roof trusses have a maximum section of only 1½ x 3 in. It is really packing box lumber, complete to knots and checks.

The Hall hut is, nevertheless, conceded advantages and, given good timber, could be more substantial. It is very economical of materials and labor, and can be rapidly transported and erected. Because of its lightness, however, it requires frequent repair. Sealing the roof joints with strips of roofing felt has also caused trouble, the best method so far devised, being to "weld" the strip by the use of a blow torch, as shown by Fig. 11 on the next page.

Fig. 9. M.O.W. precast concrete hut used as a hospital. Roof is asbestos cement. Tile walls will be painted with a cement and paste mixture that will both waterproof and camouflage them. The walls of the light lock in front of the door have been so treated.

The C'tesiphon hut

One of the most intriguing possibilities in military hut design is still in the experimental stage, but the half dozen huts that have been built at one American airfield are successful enough to justify a description. Developed by a London consulting engineer, J. H. de W. Waller, the huts consist of concrete barrel arches constructed with a corrugated surface to impart stiffness, but containing no reinforcing steel. The basic feature of the design, as stated by the de-

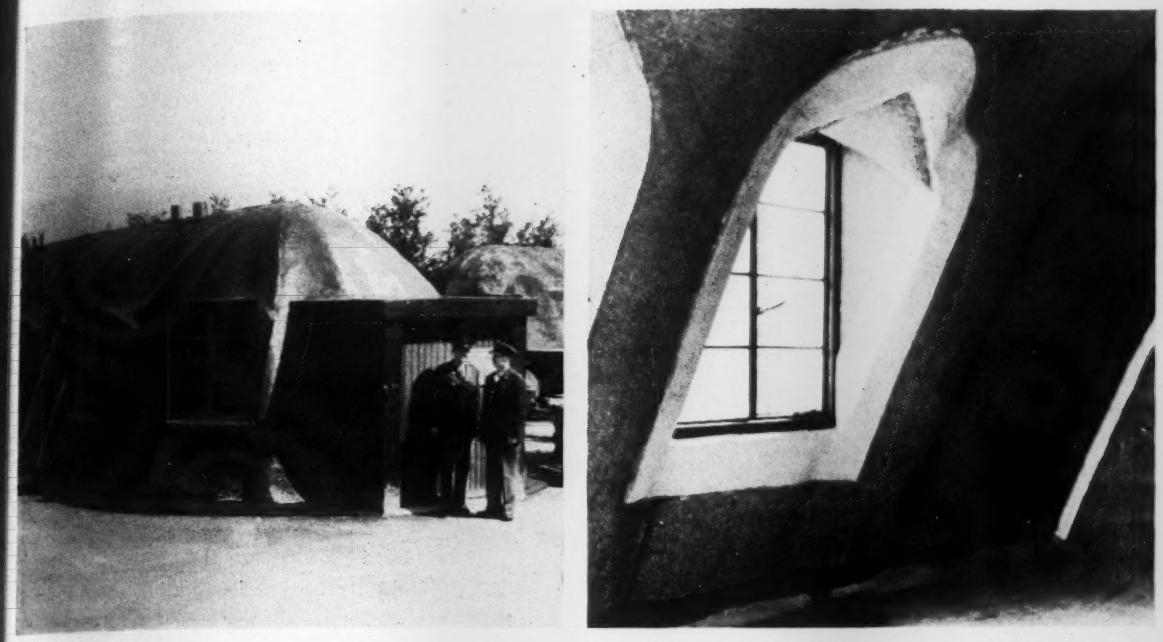


Fig. 10. C'tesiphon hut, a unique experimental type built by plastering mortar on a burlap form. Its unusual outside form (left) is matched by an equally strange inside appearance (right). During construction the burlap form is carried by arch rib centering, but the completed shell is self-supporting.

signer, is that the outline of the hut is an inverted catenary or "true" arch in which only compressive stresses can exist. Because of this feature he has given his hut the name "C'tesiphon" after a city near Bagdad where an unusually slender arch of poor quality brick, but having this "true" arch shape, has withstood earthquakes and storms for 2,000 years.

The most interesting aspect of the C'tesiphon hut, however, is its method of construction, which involves the use of forms made of burlap cloth. Briefly the method is to erect centering of wood or steel arch ribs at the locations that correspond to the ridges of the surface corrugations, and then to tack the burlap to these ribs, letting it sag between them to a depth corresponding to the valley of the corrugations. Over this, the concrete (mortar) is plastered with an ordinary trowel. By using high-early strength cement, the centering may be removed in 24 hours, the burlap remaining in place to serve as the inner wall surface or as an excellent base for plaster. In the huts so far built, a burlap of open weave type (about ¼-in. opening) has been used, but if, as the designer suggests, the mortar were to be applied by a gun instead of a trowel, a finer weave might be desirable.

The huts at the American airfield have a 2-in. thick shell applied in two 1-in. layers. A 1:4 mortar was used, being placed from a scaffold, the men working from the top down. Huts are 16, 28 and 36-ft. span, and one 16 x 36-ft. hut, requiring 7 cu. yd. of mortar, was completed by 16 men in 12 hours. On this hut the corrugations were 6 in. deep and 3 ft. apart, but these dimensions naturally increase as the span is increased. The foundations for these huts were plain concrete footings, 12 in. wide and 9 in. deep, the weight to be carried being estimated at 400 lb. per lineal foot of arch. As shown in the accompanying illustrations, provision can readily be made for dormer windows, and the ends of the huts may be enclosed by C'tesiphon, although vertical brick walls have also proved successful.

Fig. 11. An Engineer soldier uses a blow torch to "weld" strips of roofing felt over the joints of composition board panels that enclose a Hall-type wood frame hut.

Experiments are continuing, particularly studies of the durability of the C'tesiphon huts already built, but new applications of the construction are also being tried, one of unusual interest being the use of a domed C'tesiphon enclosure for an arched corrugated steel hangar of 90-ft. span. Whether this type of construction proved practicable for military structures or not, the experiments are held to be worth while.

Hangars and other structures

Two contrasting types of hangars are being erected by our Engineer troops and both differ from American practice. The "blister" hangar, belonging to the arched corrugated steel hut family, is strictly a war theatre structure, but the so-called T-2 hangar, of steel rigid frame design, could be used anywhere.

The purpose of "blister" hangars is merely to provide weather-protection for small inspection or repair work.

Fig. 12. Engineer troops use a blister hangar to protect their cement stores. These hangars, of 90-ft. span and only 20-ft. rise are often used for plane maintenance work.

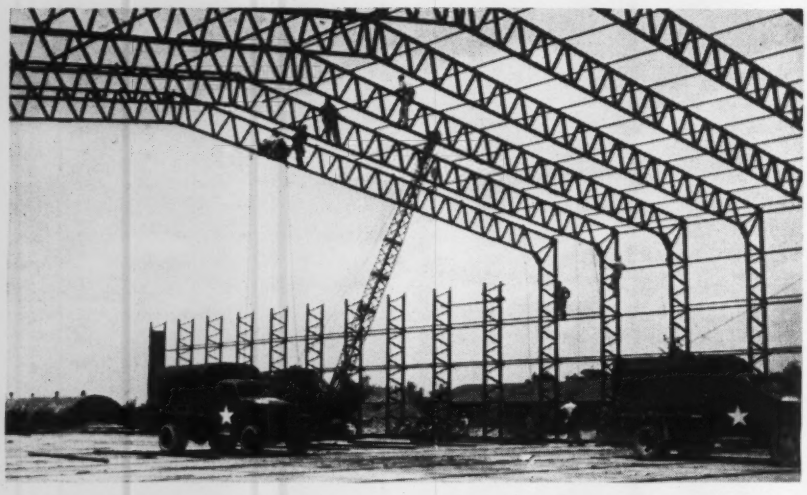


Fig. 13. Erecting a T-2 hangar whose 120-ft.-span rigid frames are shop-welded and field-bolted. They will be enclosed in corrugated metal sheets.

They come in three sizes, 62, 87 and 91-ft. spans, for which the rises of the arches are only 14 ft. for the smallest and 20 ft. for the largest, hence the term "blister." Open at both ends, except for canvas curtains, the hangars are only 25 ft. long in the short span size, and 45 ft. for the longer spans.

Structural stability for these long, low, corrugated metal arches is provided by trussed ribs and by columns set in a short distance from each end, whose bases are tied to the arch "springing" by beams over which a wood floor is placed to provide "shop areas." The remainder of the hangar floor is usually paved with tar-macadam.

The T-2 hangars, as shown in an accompanying illustration, consist of rigid frames with Warren type webbing on which corrugated metal sheets are hung to form the enclosure. The frames have a span of 120 ft. and are set on 10-ft. centers to provide a hangar 240 ft. long; they are shop-welded, but have bolted field splices. Sliding doors close the ends. Illustrating one important advantage of the T-2 hangar, one of them was recently built complete by U. S. Engineer troops in just two weeks from the time the first frame was set.

Americans learn to lay brick

Although huts and hangars comprise the bulk of the buildings at American military installations in Great Britain, there are several other structures that warrant brief mention. Chief among these are the tanks of the water supply and sewage disposal systems, and of particular significance are those of brick construction.

The British are accomplished craftsmen in this type of work, but only one out of a hundred of our Engineer troops could lay claim to previous experience as a bricklayer. Brick masons, therefore, had to be developed, and it is a credit to the men that many of them started out laying 200 bricks in a ten-hour day, and in a matter of weeks were up to 750 bricks in the same length of time.

Even such creditable speed, however, is none too fast considering the amount of brick laying involved. Sewage plants, for example, are entirely of brick. Two circular trickling filter tanks, shown in Fig. 14 on the opposite page, are the principal structures, but in addition there are rectangular primary and final settling tanks, and the sludge drying beds (composed of coke) are also in the form of a rectangular brick tank.

Elevated tanks of brick

Brick construction also is required for some of the elevated water tanks, although the more common structure for this service is a square box-shaped steel tank on a 50-ft. high structural steel tower. Built entirely of standard size flanged steel plates, about 3 ft. square, which are assembled by bolts, these tanks are usually of about 90,000 gal. capacity. They can be erected rapidly and have proved to be an excellent type of tank for military purposes.

When time is available to build brick elevated tanks, they are used in the interest of steel conservation. The "tower" consists of brick walls, across the top of which steel I-beams on about 5-ft. centers are placed to support the concrete slab bottom of the tank itself. Tank walls consist of an inner and outer row of bricks, built up to furnish the form for a filling of reinforced concrete about 9 in. thick.

The mortar joints of the inner row of brick are scored deeply to furnish effective bond for a cement mortar lining, which is covered with a bituminous waterproofing. Roofs of such tanks are usually a flat concrete slab spanning between the walls.

Finally, it is not only on such major items as huts and structures, but in certain details of building that British practice is shaping the facili-

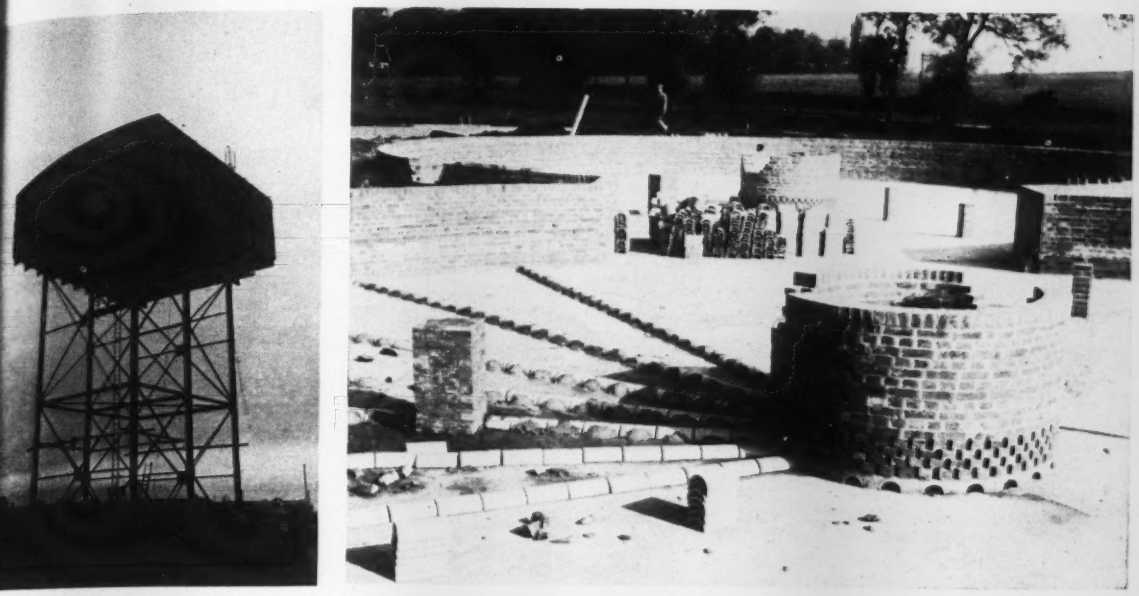


Fig. 14. Tanks are among the larger of military camp structures. That at the left is made up of bolted flanged panels, both shell and bottom. At the right is shown the brick construction of the trickling filters at the sewage plant.

ties at the American camps and air-fields in the European Theatre of Operations. As examples, two roof designs may be cited. One of these involves the use of unreinforced pre-cast concrete beams, of railroad-rail cross section about 6 in. deep and 5 in. wide, which are laid side by side to form roof slabs up to about 12-ft. spans; the edges of the top flanges are stepped so that they overlap at the joints, which are filled with cement grout. The construction is completed by a covering of tar and roofing felt.

A second type of roof that also avoids the use of either wood or steel has cement-asbestos tubes for beams and purlins, the covering being corrugated cement-asbestos sheets. So far, this framing has been confined to brick-wall corridors about 6 ft. wide that provides weatherproof passageways between some of the more important buildings. The tubes placed transversely are 4 in. in diam., and are installed about 5 ft. apart to support three lines of 2-in. tubes as purlins.

The connection between the beams and purlins is effected by a short precast concrete rod over which the ends of the purlins can be slipped, and which is equipped with a metal dowel that fits tightly into a hole in the top of the beam tube. Although of strange appearance, this framing is conceded to be effective and economical, and is speedily and readily erected.

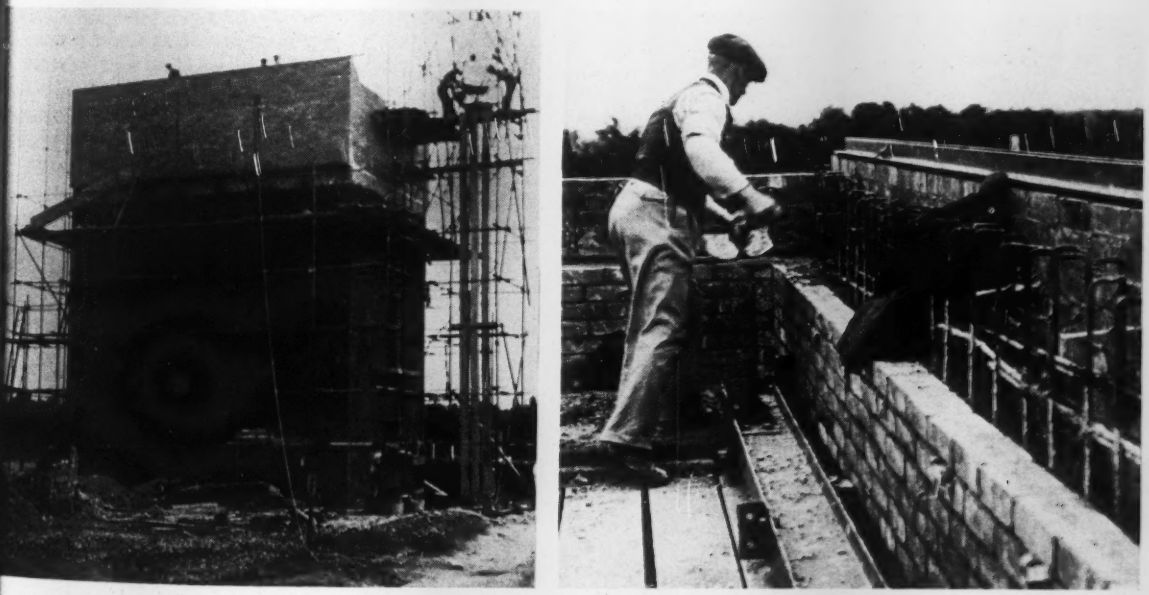


Fig. 15. Elevated brick water tank carried on a 35-ft. brick "tower", which has already received its camouflage paint. View at right shows the concrete filling of the tank walls being deposited between brick forms.

Construction After the War

● Despite much salutary discussion, few carefully considered viewpoints on postwar construction projects have been available. The subject is a vital one, regardless of the length of the war, and now that the psychological wall that shut off discussion for so many months has been pierced, authoritative analyses can do much to stimulate constructive thinking and planning. The three following statements by particularly qualified engineering and construction leaders constitute an auspicious start in this direction.

By George A. Bryant

President and General Manager, The Austin Company
Cleveland, Ohio

CONTINUOUS CLOSE CONTACT with capital goods and consumer industries, railroads, airlines and various government agencies from coast to coast forms the basis for our belief that industrial engineering and construction work in this country will continue at a level well above the 1936-39 average in the immediate future and after the war is over. While the domestic work in prospect is sure to represent a decline from the abnormal peaks reached in the last half of 1942 and the first half of this year, it may well exceed the average of the '20s, when industrial building activity reached its prewar high.

The accumulated requirements of basic consumer goods, service and distribution industries represent a large backlog in themselves. Quite apart from the necessity of just keeping up with expanding demands, some firms in these fields recognize the need for drastic changes which will require new construction or the complete revamping of existing plants.

In textiles, the need for additional rayon producing capacity is especially significant. A large part of this industry's normal output has been diverted from apparel and household fabrics to special war uses, and the biggest single portion is going to the tire industry which cannot make synthetic rubber tires without it. With everything pointing to the continued use of synthetic rubber after the war, the rayon industry is looking forward to steadily expanding markets which will take all the tire yarn that existing plants and others now being built at the government's request can produce. This means that a substantial volume of new construction will be necessary just to replace the volume diverted from usual textile uses and bring regular production back to normal, before we can begin to meet new demands resulting from the absence of silk and rayon imports.

Photo, The Austin Company

Available for postwar—thin steel and glass-wool walls with high insulating value. Located in Texas, this windowless aircraft assembly plant has been air conditioned during two years of around-the-clock operation for $1.32 per man-month, or about 5c. per man per day.

Prospects in transportation

Transportation — including railroads and airlines—probably offers the most promising outlook of any single industry. With the railroads in the strongest financial position in many years, the more progressive roads are showing active interest in construction of thoroughly modern maintenance shops for the first time since the depression. The shift in traffic movements on some roads has been so great over a period of years that entirely new shop locations are being considered to eliminate lost mileage and minimize interference with operating schedules.

Extremely alert to the growing competition from motor freight services, and anticipating the early establishment of low cost airfreight service to many centers, some roads are already taking steps to provide more adequate freight terminals in established centers and new terminals at other important points.

Engineers are already at work on the design of air terminal facilities for the postwar era. With 400-pas-

nger transports and cargo planes signed to carry over 150,000 lb. f freight now being developed, con- rete runways 500 ft. wide, over a ot thick, and between two and three iles long may soon be needed. tarting with an estimated cost of t least five million dollars for each ch runway, major air terminals ill probably represent an invest- ent of between twenty-five and one ndred million dollars, depending pon their size and the extent to hich they provide special facilities r interchange between main and eder lines, for private planes and ir taxis, and for transfers between ilroad, truck and air freight lines.

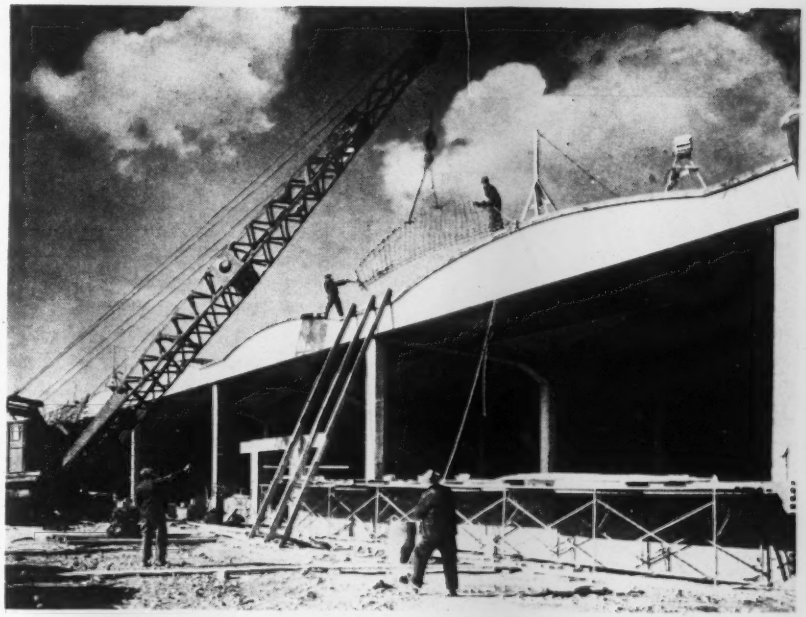
The need for auxiliary fields to be ed by feeder lines serving second- y industrial and commercial cen- rs throughout the country will call r the construction of hundreds of mall modern airports; and the ggregate investment in such layouts ay exceed that for the larger ones.

While the need to develop new oducts to meet special wartime eeds has greatly accelerated the gen- al pace of research activity, much f this work was carried on in exist- g buildings poorly suited for such se. Recent developments in our asic process and manufacturing in- ustries have accentuated the need r even more intensive research and velopment work by any company at expects to hold its own in the ostwar period. The larger firms ave been quick to recognize this fact nd many are taking steps to provide ore adequate facilities. Some have lready authorized the preparation of lans.

Future of the war plants

While the chance of filling any sub- tantial part of the special needs eretofore listed by the conversion of xisting war plants or facilities is ex- remely limited, it should be said that he government is already taking steps o insure the continued use of all overnment-financed and government- wned properties which can be eco- omically adapted to peacetime uses.

Industry itself is pursuing the same bjective, with a great many com- anies planning to negotiate for the urchase of Defense Plant Corpora- ion plants which they have operated nd intend to make their permanent omes. Other concerns are actively earching for plants which will be vailable after the war, with a view



Photo, Albert Kahn Associated Architects and Engineers, Inc.

Largest plant in the world, Dodge Chicago works of the Chrysler Corp., exemplifies the use of reinforced concrete for single-story factory structures, and features, a new type of arched roof construction.

to utilizing them as distribution centers or for the decentralization of certain manufacturing operations. Such programs, and the readjustment of many industries to peacetime production right in the plants where they have been manufacturing and assembling special war equipment will require a considerable amount of construction, to which professional engineers experienced in all phases of design and construction can make a real contribution. Some firms have already recognized this fact by the award of "maintenance" contracts which give outside engineers the major responsibility for the execution of such work.

Industry as a whole has cut costs tremendously by the adoption of more efficient production equipment, improved layouts and the use of mechanized handling facilities. Many firms, however, have stopped short of the major decisions which would have enabled them to capitalize to a far greater extent on improvements actually made. In some instances, they have failed to provide the working conditions that would have materially increased the efficiency of their employees. In others, they have missed their opportunity for complete coordination of their production activities. Still others have sidestepped questions of relocation and decentralization that would have greatly reduced costs to the ultimate consumer.

There is a growing awareness of these factors, and some firms are going so far as to authorize us to place orders now to give them first call on building materials and equipment likely to be in greatest demand when restrictions are lifted.

We anticipate a second flood of activity when industries which have been coasting along on easy profits in a seller's market wake up to the fact that competitors in more modern plants have improved quality and have cut costs to a point which seriously threaten their survival.

Work in foreign countries

In addition to the domestic work in prospect, there will be an unpredictable volume of work overseas. Whether such enterprises are undertaken and financed by American, British or native capital, America is going to have to provide much of the engineering and the management.

Plants designed for postwar construction here and abroad will incorporate the cumulative improvements in building materials, equipment and techniques, many of which have been reserved exclusively for direct war application. For example, several factors have combined to insure economy in future industrial air-condi-

tioning installations. First among these is the increased efficiency and lower cost of the units themselves brought about by the impetus of large scale production for marine and other war installations. This has been enhanced by the reduction in heat output obtained by the use of fluorescent lighting. A third important factor has been the high degree of insulation first obtained through the use of steel and glass wool in walls and roofs, and subsequently by "breathing" masonry walls which proved equally effective, if more expensive.

Wartime emphasis on the conservation of steel and other critical materials has also stimulated the development of many new systems and structural forms possessing the virtues of strength, durability, economy and good design which insure their continued use.

Improved power distribution and lighting systems designed to save copper wiring in large aircraft plants have already been accepted as the future standard for modern plants.

Wide-span, rigid-frame concrete arches, developed to take the place of steel in several alloying plants where corrosive fumes were present, are proving more satisfactory than the steel they replaced. Where such plants would normally have used standard asbestos protected metal for roof ventilators, the engineers went all the way in concrete, devising a continuous roof ventilator with precast slabs which fit into key plates that were poured in place.

The extensive use of prestressed concrete tanks for fuel storage and the development of precast concrete systems for construction of marine ramps and other structures has likewise opened up long term opportunities for the use of concrete for such functions.

At the same time, the perfection of new laminating processes has broadened the postwar horizon for timber by conclusively establishing its adequacy for certain purposes.

As new products that stem directly from wartime research are adapted for use in industrial plants and commercial structures, we can look forward to construction which will give steadily increasing value for every building dollar, with assurance of minimum maintenance expense.

By Louis Kahn

President, Albert Kahn Associated Engineers and Architects, Inc.
Detroit, Mich.

THE COMPRESSED KNOWLEDGE gained by the forced test of wits since Pearl Harbor has speeded the obsolescence of America's going production plant; and this factor, added to the civilian markets to be refilled and the inventories to be rebuilt, throws the white light of hope down a long stretch of coming years. Barring the disaster of total inflation, there should be work for many hands for many years ahead.

Neither myself nor any of the twenty-five associates who are partners in our 600-man organization expect any serious let-up in the construction field as a result of competition from production floor space added under the emergency war plant program. It should be recorded, of course, that within the Albert Kahn Organization you will find as many differences of opinion on specific phases of postwar design and construction as you will find in any miscellaneous group of informed and experienced men. But on one over-all post-war trend they are in complete agreement:

The demand for new plant construction and for remodeling of existing structures will be immediate and enormous the instant peace comes. This condition will be forced by the sheer economics of production costs. In the intense competition of the postwar period, where hair-line profit margins are indicated, the manufacturer housed in an obsolete plant will be at an insurmountable disadvantage against the producer in an efficient layout.

Many people assume that because of the vast number of war plants erected since Pearl Harbor, America will be industrially over-built after the war. We, who were the architects and engineers on many of the larger war-born projects, do not share this belief. Most of these structures were designed for a specific purpose and to adapt them to production of civilian items will, in most cases, require extensive alteration. In some cases it may be cheaper to start from scratch.

Two orders were paramount in war plant construction: One, get it up as fast as possible, and two, use a minimum of critical materials. Every short-cut that would save time and materials without impairing the efficiency of the operation was taken. The result was a finished manufacturing operation entirely adequate for its specific job but hardly in line with the recommendations we would have made had manufacturing profit been the paramount consideration, instead of time and materials.

Lighting requirements different

A simple illustration of this is provided by war plant lighting. In private plant design every bay and department would be individually controlled so that fuel could be saved when those units were not in operation. But we knew that every department of a war plant would be in full operation. Consequently there was no need to take the time and materials to install individual switches, and the time of an operator to pull them. Frequently twenty or thirty light circuits were hooked to one master switch. For private operation, those circuits will have to be individually controlled as a cost reduction factor. The same thing applies to heating and materials handling; in fact the entire plant will have to be resurveyed with a view to getting manufacturing costs to a low competitive basis.

On the other side of the ledger war construction has forced certain developments that will improve postwar building. For example, we have developed a factory sash of wood which has certain advantages over steel. We are using plastic types of flashing instead of copper and galvanized iron. And finally we were of the opinion that concrete buildings were uneconomical and ill-suited for one-story factories, but during the recent trying years, we have developed types of concrete construction that permitted speed and economy in erection; and no doubt these types of construction will be adaptable for many types of one-story factories and may, in some instances, be preferable to structural steel.

One question often asked is whether we anticipate a trend to the large self-contained plant, and while we can marshall a wide variety of opinion on this subject, the consensus nevertheless, is negative, for sev-

ral well-considered reasons. War lants in widely scattered parts of e country, including the agricultural outh and Midwest, are training new urces of labor in machine operation, that there may be a trend away om industrial concentration in ur- an areas in order to be near a upply of skilled workers. Also, ider availability of power may tend de-centralize industry and attract to areas of cheaper rentals, taxes nd other non-production costs.

One of my associates points out hat plastics may bring a trend in lants to smaller structures. Develop- ent of plastics, he believes, may par- llel the experience of the automobile ndustry. Thirty years ago no one lant built a complete car; the home actory of the company was nothing ut an assembly plant, drawing parts om many small individual manu- acturers. A similar trend in plastics ould call for many small plants in any scattered areas.

The rate of expansion of industrial ir conditioning will likewise be de- ermined by the cost factor. Where it essential to manufacturing accur- cy, or where it raises plant produc- on or office building rentals suffic- ently to offset the cost, it will be tilized. New plant installations will ave to be sold on the premise that ey can show a profit, or at least reak even, on the investment.

Windows or windowless?

Closely related to the human factor f air conditioning is the matter of indowless plants. The Kahn special- st on windows does not anticipate a ajor advance toward the non- indow concept. He tells an interest- ng story of one plant erected with a iew to total conformity with black- ut ideas then in vogue. Windows ere high and of special glass lacking e clarity of a transparent pane.

The plant was opened in midwinter, e windows survived the cold eather period, but after the first almy days of spring, the rate of indow breakage went far above ormal, because the workers wanted e feel of that outside air. It is logi- al to assume that if this particular lant is converted to civilian produc- on after the war, and works only a ay shift, the installation of regular indows may be desirable. Even the perators of some windowless plants re not sure the concept is right, and hile this indecision remains, cer- tainly no definite trend is indicated.

Whatever the trend in details of plant structure and equipment, it is clear that the over-all indications are for great postwar activity in the build- ing and construction fields, both for modernization and for new buildings to meet new civilian needs and to catch up with the backlog of business necessarily delayed by wartime re- strictions.

It adds up to a happy prospect for the construction industry and its sup- pliers.

By Morton C. Tuttle
President, Morton C. Tuttle Company
Boston, Mass.

THE CONSTRUCTION BUSINESS rides in the caboose of the industrial freight train. It is the last car to start.

In the past the rise in volume of construction has followed, not ac- companied, a rise in general business activity. This relative time-lag in con- struction activity is so long that a building boom has commonly occur- red when general business activity was approaching the height from which it makes its periodical and spectacular dives. Since investment in buildings is a final fixation of capital, necessity must be impelling, or pros- pect of profit alluring, before money is put into buildings.

Also, in forecasting the conditions of the postwar building trade, we must decide whether building costs will then be rising or falling.

If, immediately following the war, price indices are rising, and if that rise be attributed to inflation, how will buyers of buildings react to that prospect? During inflation saleable property is better than cash. Will buildings be considered a good hedge against inflation?

Under our present tax laws there is but limited opportunity for any busi- ness to build up surplus, and it is from growing surplus that business draws courage for long-term invest- ments. Will the treasurer, who is the "no" man of any industry, re- quire very convincing proof of ne- cessity or else vital assurance of con- tinuance of large profit, before he dips into capital to provide more building space?

Millions of feet of factory and storage space, paid for by govern- ment money, will be vacant after the war. Is is probable that out of consideration of the interests of the building industry, the Government will refuse to sell or rent vacant warehouses and factories?

Will factory space be available at less than replacement cost?

Rent is an operating expense and as such deductible from taxes while only depreciation is allowed on owned buildings. Will the manufac- turer requiring added space be tempted to rent rather than build new factories?

The change from producing war necessities to manufacturing and mar- keting civilian goods cannot be made instantly. If the war demand tapers down gradually, affording oppor- tunity for re-equipping and re-man- ning the factories and warehouses that supply civilian goods, will this result in heavy demands on the build- ing industry? The results of com- plete stoppage of all war orders is too tragic to be considered.

Railroad equipment, motor cars, trucks, radios, washing machines, re- frigerators, women's shoes, rubber goods of all kinds, commonly appear on the lists of items for which there will be huge demand after the war. Demand for such items promises em- ployment for thousands of people. How will these accumulated demands effect the building industry? If we examine the plants of the producers of many of these products, we can- not but be impressed with the extent of their facilities.

It is obvious that after the war there will be a considerable volume of work to be done by the building industry. Plants must be re-equip- ped, and additions made in the struc- tures.

There is undoubtedly a dammed up demand for modern housing, par- ticularly of the small single-family type, and for group housing.

Public opinion is becoming intoler- ant of our slum areas. Many of these are marked for cleaning up. Cities, states, and the national government are now planning public works.

Postwar business may be satisfy- ing for some of the units of the in- dustry, but for the industry as a whole the immediate postwar period may well be a time for deflation.

Radiant Heating for a War Building

Ernest L. Blair
Industrial Engineer, Stone & Webster Engineering Corp., Boston, Mass.

***Contents in Brief**—The heating system for a large service building provides for the circulation of hot water through an extensive piping network embedded in the concrete floor slab. The building was divided into four zones because of the varied operations housed, and independently controlled facilities were installed for each area. The step-by-step procedure followed in designing the system for one zone is outlined.*

RADIANT HEATING FACILITIES were installed recently in one of a group of buildings required in the expansion of an eastern war plant. The building to which this unusual method of heating was applied is a one-story structure, 80 x 280 ft., essentially utilitarian in character, and designed to conserve critical materials. It has brick walls, wood-sash windows, timber columns, plywood roof trusses, an insulated plywood roof and a concrete floor laid directly on the ground. The west end, comprising 6,400 sq.ft., is occupied by the personnel department and is divided into reception, waiting, interview, examination and medical rooms. The remainder, totalling 16,000 sq.ft., is occupied by two cafeterias, each seating 450 people, and a kitchen centrally located between the cafeterias.

Due to the fact that there were few large installations of radiant heating to serve as a guide, the Stone & Webster Engineering Corp., which designed and built the structure, found it necessary to do a considerable amount of pioneering in the design studies.

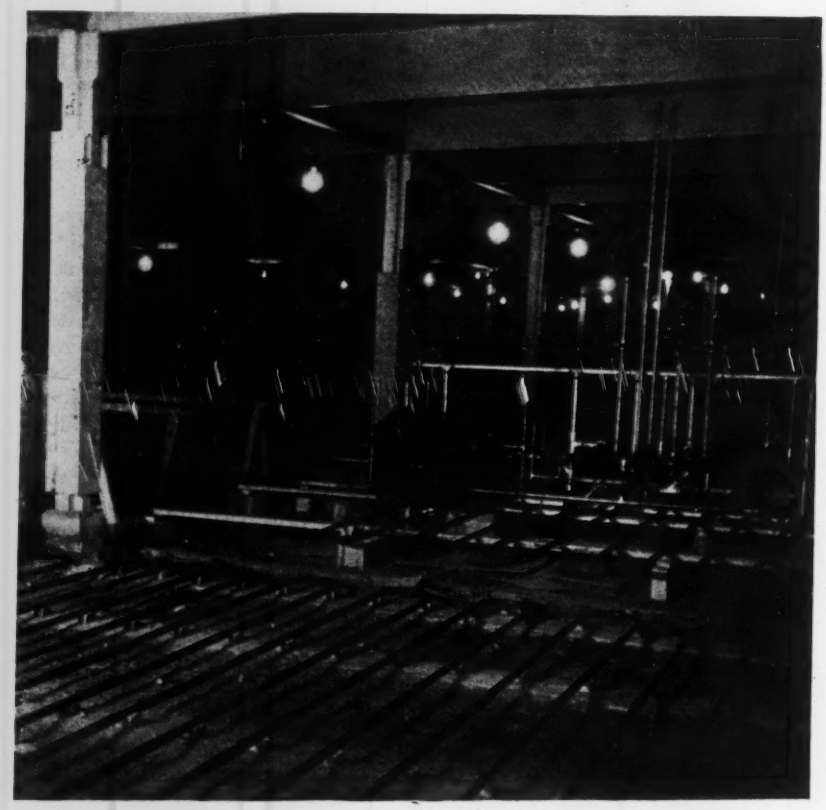


Fig. 1. Piping network for one of the cafeterias in place ready to be tested under hydrostatic pressure of 500 lb. After the test, the concrete for the floor was added, which provided a 4½-in. cover over the pipes.

Radiant heating was adopted for this particular building because it appeared to present certain definite advantages over more normal methods. As the building had no basement, a steam heating system would have required overhead supply lines with exposed vertical drops to the wall-hung radiators. Return lines also would have had to be largely exposed or buried in trenches below the floor. A radiant heating system installed chiefly in the floors, on the other hand, eliminated all exposed supply and return lines and all radiators, thus increasing the usable floor space. In a few small rooms where adequate heat could not be provided from the floor without raising its temperature too high for comfort, heating panels in the partitions were employed.

Hot water was chosen as the heating medium because of the low temperatures that could be used and because it could be controlled by a simple and convenient system of forced circulation.

The floor was divided into four sections corresponding to the four zones into which the building was divided for heating purposes. Floor slabs in these zones were separated from each other, from the side walls and columns by expansion joints of width adequate to permit each section to expand freely with changes in floor temperatures.

Calculation of expected losses

Expected heat losses from the building were calculated in the conventional manner. A minimum air temperature of 70 deg. F. was assumed for the office space and 65 deg. for the cafeteria and kitchen areas.

Calculated hourly losses were as follows:

West office zone	157,000 B.t.u.
Center cafeteria	120,000 B.t.u.
Kitchen zone	94,000 B.t.u.
East cafeteria	160,000 B.t.u.
Total	531,000 B.t.u.

In calculating the required heat input into the floor slab, which was to be placed directly on the ground, a loss of 30 percent into the foundation soil was considered possible. Thus, the total required heat input into the floor was 531,000 + 149,000 = 680,000 B.t.u. The figure 149,000 is slightly less than 30 percent of 531,000, as a small portion of the heating requirements is furnished from partitions. The total 680,000 represents 1.85 B.t.u. per hr. per cu.ft. of heated space.

The design of the pipe network was based on a mean water temperature of 105 deg. F. at 0 deg. outside temperature and a temperature drop in the heating system of 20 deg. Maximum temperature of the floor slab in the constantly occupied areas was not to exceed 85 deg. A floor temperature up to 95 deg. was permitted for entrances, toilets, etc., where the length of occupancy is limited and physical discomfort would not result.

The basis for the required temperatures of the floor slabs in the different areas and the size and spacing of pipe coils to furnish this temperature were determined from data originally published in the September, 1941, issue of *Plumbing and Heating Business* in an article entitled "A Working Method for Calculating a Floor Type Radiant Heating System." From that article the charts of Figs. 2 and 3 were obtained.

For the east cafeteria the required heat output from the floor equalled $\frac{160,000}{5,520}$ = 29.0 B.t.u. per sq.ft. per hr. The required floor temperature was determined by use of the curve reproduced in Fig. 2. An output of 29.0 B.t.u. per sq.ft. hourly shows the floor will have a maximum temperature of 83.8 deg., which is below the permissible 85 deg. maximum for this area. When the 30 percent loss into the foundation soil is added, the heat input into the floor equals 29.0 + 8.7 = 37.7 B.t.u. per sq.ft. per hr.

The required size and spacing of the heating coils to supply this amount of heat was calculated by use of the curves in Fig. 3. For the assumed temperature of 105 deg., Fig. 3 shows that 1-in. pipe on 12-in. centers would supply 42 B.t.u. per sq.ft. hourly and 1¼-in. pipe on a 18-in. spacing, 35.5 B.t.u. The 1-in. pipe was selected, as this size was to be most commonly used and as a slight adjustment of the mean water temperature would permit the required heat input to be supplied. A total of 5,200 ft. of pipe was required for this area, and it was divided into four circuits.

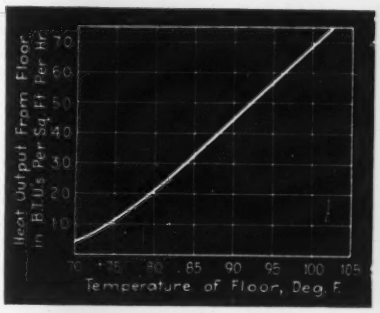


Fig. 2. Heat output from the floor was calculated by use of the above curve. In constructing the graph, the desired air temperature in building was set at 70 deg. F.

The total heat input needed for the east cafeteria equalled 37.7 × 5,520 = 208,000 B.t.u. per hr. The quantity of water to be circulated in the area equalled

$$\frac{208,000 \text{ B.t.u.}}{20 \text{ deg.} \times 60 \text{ min.} \times 8 \text{ lb. per gal.}} = 21.7 \text{ gpm.}$$

For the west cafeteria, which has two exposed walls, the system was designed for a floor temperature of 80 deg. About 3,600 lin. ft. of 1-in. pipe on 18-in. centers was required. Three pipe circuits were used.

The kitchen zone is divided into a number of different rooms, including toilets, locker rooms, entrances and offices. The main kitchen area has a designed maximum floor slab temperature of 77 deg. with 1-in. pipe on 24-in. centers. The systems for the toilets and vestibule were designed for floor temperatures of 90 deg. In these areas 1¼-in. pipe on 12-in. centers was used. The kitchen zone was divided into three pipe circuits.

The most difficult problem was to heat the personnel examination area or office zone, as this area was subdivided into many differently sized rooms. The interview rooms have 8-ft. high partitions separating them from the main office space. The ratio of floor area to heat loss made it impossible to install sufficient piping in the floor without extremely high floor temperatures. Owing to the partitions being open at the top, part of the heat loss was allocated to the main office area and additional pipe was installed in that area to reduce floor piping requirements in the interview rooms. In addition, a few separate wall coils of 1¼-in. pipe on 12-in. centers were installed. For the interview rooms the designed floor temperature is 85 deg. and 1-in. pipe on a 12-in. spacing was used.

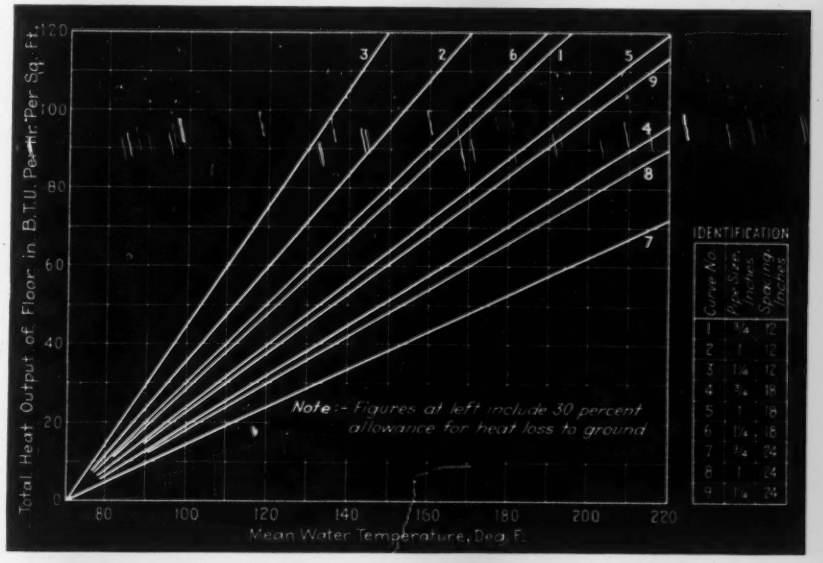


Fig. 3. Relation of the heat loss from the floor to the mean water temperature and pipe spacing is shown by this chart. It is based upon a transfer of 3.5 B.t.u. per hr. per sq.ft. of pipe surface for each degree of difference between the water temperature and that of the air in the building.

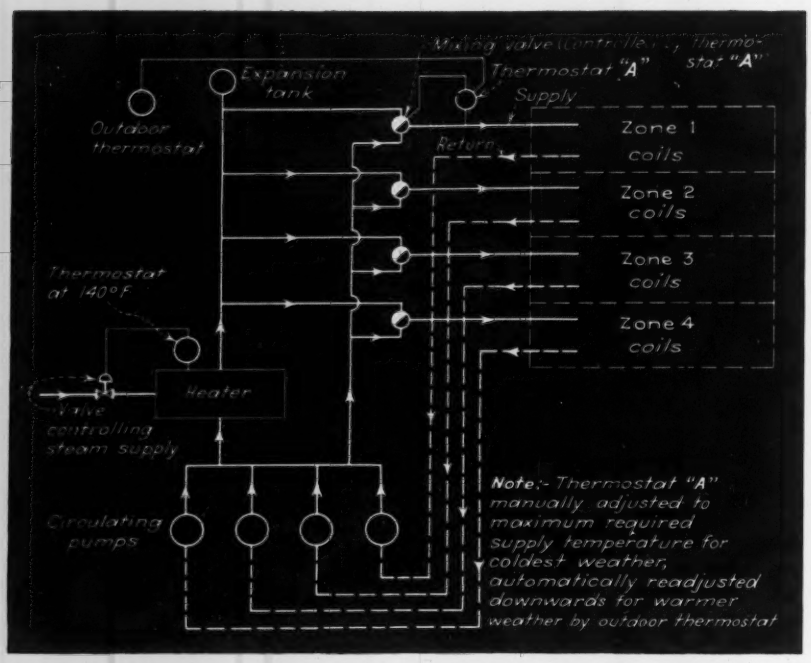


Fig. 4. Flow and control diagram for the four-zone heating system. Thermostats similar to thermostat "A" shown for Zone 1 were installed for the other three zones, but were left off this drawing for clarity.

In the main personnel area, where 1-in. pipes were installed in the floor on 24-in. centers, the designed floor temperature was 77 deg. In the toilets and the main entrance the designed slab temperature was 96 deg. and 1¼-in. and 1½-in. pipe, mostly on 12-in. centers, was installed. Because the floor area was broken up considerably, this portion of the building was divided into six circuits.

Wrought iron pipe used

Standard-weight wrought pipe was used throughout for the pipe networks. In all, over 15,000 lin.ft. was installed, including 13,500 ft. of 1-in. dia. The balance was of ¾-in., 1¼-in. and 1½-in. size. The pipe was bent cold on the job and assembled in sections above the spot where it was to be used. After being welded together, the coils were laid in position and the final connections welded in place. A 500-lb. hydrostatic test of from 12 to 24 hr. duration was made for each circuit. A portion of the installation, before placing the concrete for the floor slab, is shown by Fig. 1.

Before the concrete slab was poured the pipe was supported roughly 2 in. above finished grade, which provided about a 4½-in. cover of concrete. During the placing of the concrete, water at a temperature of 100 deg. F. was circulated through the pipe networks. Circulation continued until the concrete had set. This procedure, which allowed the pipe and concrete to attain an approximate average point of expansion, proved to be effective in preventing cracks in the finished surface of the floors.

The circuits in each of the four zones into which the building was divided were designed for a rational balance between the small quantities of water to be handled and the pumping heads. A pump driven by a 1½-hp. motor was installed to distribute the 21.7 gpm. of water needed for the east cafeteria against a 68-ft. head. For the three other zones pumps with 1-hp. motors were installed to handle from 14 to 20 gpm. at a head of from 62 to 65 ft.

Numerous balancing valves which, by the nature of the system, would be difficult of access were eliminated by designing the circuits for equal pressure drops. As a result in the initial tests, most of the sixteen circuits were found to be so well balanced that it was necessary to install valves in only a few circuits.

The relative assembly of the circulation and heating equipment as finally decided upon is illustrated diagrammatically by Fig. 4. The hot water converter, circulating pumps and controls shown in Fig. 4 are located in an equipment room in an adjacent building, due to lack of space in the personnel building. Steam is supplied to the converter at 10 psi. A self-contained regulating valve maintains a constant water temperature. Outside the building the four hot water supply lines and the returns were placed underground in a trench. Inside they were extended under the floor to the various zones.

Care was taken throughout to allow for expansion and contraction in the connections from the underfloor mains to the piping in the slabs. Expansion of the water in the system was taken care of by the installation of a 125-gal. closed expansion tank. A combination pressure reducing and relief valve also was installed.

Control of the heating system

The four pumps, one for each zone, installed to circulate the hot water operate continuously. The temperature of water supplied to each zone is controlled by a three-way mixing valve, which is operated by an adjustable immersion thermostat with remote control located on a main panel board. The basic water temperature for the thermostats is regulated by an outdoor pilot thermostat. The remote control adjustable feature of the thermostats permits increasing or decreasing the basic temperature to meet variable demands in the different zones.

As a case in point, the personnel area has an asphalt tile floor, while the rest of the areas have monolithic floors. The asphalt tile floors will require a water temperature 10 to 15 deg. higher than the monolithic floors. Moreover, in the kitchen, lower water temperatures will be required during rush hours than in the other zones. By manual operation of the immersion thermostats from the panel board these variations can be accommodated.

The heating system has not operated sufficiently long to determine whether a less liberal allowance for the heat loss into the ground would have been satisfactory. However, preliminary tests indicate that possibly a smaller allowance would have been adequate, as comfortable inside temperatures have been maintained in severe weather with slightly lower water temperatures than the design studies would show necessary.

Sao Paulo Tower is Righted with Jacks

A 24-STORY OFFICE BUILDING in Sao Paulo, Brazil, that leaned more than 2-ft. out of plumb when one corner of the foundation settled, has been righted by ingenious means involving the freezing of subsoil, installation of deep concrete piers and hydraulic jacking. At the end of August, after 21 months of work, the building had been pushed back within ¼ in. of its original plumb condition.

A 300-ft. high reinforced concrete frame structure, the building had almost reached completion in July, 1941, when it was discovered by elevator installation engineers that it had settled at one corner (far right in the picture). The movement was such that the building was 25.5 in. out of plumb on the street side and it also leaned 23.6 in. toward the side adjacent to the excavation being made for another building. Investigation showed that this new excavation had started movement in a lense of fine, wet sand surrounding a group of concrete piles that supported one corner of the building.

Initial efforts to halt the settling included first the use of cement grouting, which was unsuccessful, and then injection of an aluminum salt in an effort to coagulate the soil; this latter method likewise proved futile. This led to the decision to freeze the soil, using for this purpose 160 double-walled circulation pipes, of 2 and 4 in. diameter, respectively. These pipes were driven to a depth of 60 ft. into firm ground that lay beneath the lense of quicksand, which was quite close to the ground surface.

Following an 8 months' period of circulating brine solution through the pipes the block of ground was frozen to a temperature of minus 20 deg. C. Holes of about 4 ft. diameter were then excavated through the basement of the building down into the frozen block into the firm soil. These holes, located adjacent to the columns of the building were then filled with concrete to form piers.

The piers, poured to an elevation slightly below the existing column footings, served to support hydraulic jacks. The concrete used in the piers contained an admixture of calcium chloride to accelerate setting which otherwise would not have taken place under the abnormally cold temperature prevailing in the frozen ground. Incidentally, the cold was so intense that the jack hammer chisels used for making the excavation became so brittle that they frequently broke after a few minutes of use.

Serious settlement of a corner of this tall concrete building was recovered by jacking it onto new piers sunk through artificially frozen sand.

A total of 40 jacks, ranging in size from 100 to 950 tons each, were employed to right the building. Numerous small cracks have appeared in the plastered brick walls of the building, but it is believed to be structurally sound. The cost of realignment work will total abou' 50 percen' of the original construction cost of the building.

The work is being done by Severo, Villares & Cia., Ltda., of Sao Paulo, Brazil, who also designed and constructed the building. The straightening operations were developed and executed under the direction of Arnaldo Dumont Villares, partner and civil engineer of the firm. Foundation piles were placed by Estacas Franki, Ltda., a subsidiary of the Belgium company of similar name. The building is owned by the Compania Paulista de Seguros.

Aircraft Plant has 150-ft. Timber Trusses

Light timber trusses** spanning between **the main 150-ft. trusses support the roof for this large all-timber plant for the Douglas Aircraft Co. Inc.

***Contents in Brief**—Construction of a modern aircraft factory at a time when steel and other critical materials, including first-grade structural timber, were exceptionally scarce created a real problem in design. Built in ten months, this all-timber plant contains heavy timber trusses up to 150-ft. spans and 54-ft. high laminated timber columns. Substituting non-critical materials wherever possible saved 30,000 tons of critical metals. An efficient plant layout provides for straight line production of mammoth 4-motored cargo-transport planes.*

TIMBER HAS BEEN USED extensively as a substitute for steel and other critical materials in the construction of many recent war plants, but one of the greatest demonstrations proving the practicability of heavy timber construction in large modern plants is that of the recently completed Chicago Aircraft Assembly Plant, where Douglas Aircraft Co. Inc. is producing the C-54 four-motor cargo-transport. Construction of this mammoth plant occurred at a time when not only steel and other usual building materials were exceptionally scarce, but also during an unprecedented shortage of first-grade structural timber.

Within ten months from the time construction first was started, the more than 1,300 acres of fertile farming land chosen for the site was graded and drained, and the entire plant was completed with machinery installed ready for operation. An L-shaped daylight factory building is centrally located between administration and service buildings facing the highway and the paint shop and hangar on the opposite side. Auxiliary buildings include an administration building, garage, boiler house, cafeteria and a personnel building that houses the first aid and medical departments.

Intervening between the large factory and the hangar is a concrete-paved service area of 1,300,000 sq.ft. Beyond the hangar is an airfield of modern design with long, unreinforced concrete paved runways to serve the cargo planes. Parking areas accommodating 6,800 cars are also provided.

Many non-critical materials used

The substitution of non-critical materials for critical metals normally used in a structure of this type was a continual challenge to the ingenuity of the designers, who successfully expanded the idea of "saving steel by substitutions," even to the small fixtures that usually go unnoticed. For instance: Wooden push-bars replace brass or chrome plated steel bars on the office doors; window frames are wood; downspouts for roof drainage are fiber instead of metal; tray-slides and railings in the cafeteria are of timber instead of stainless or chrome plated steel; manhole covers, powerhouse gratings and similar installations all are of wood instead of the conventional cast iron or steel.

Even to the casual observer the absence of steel throughout the plant is readily apparent. Except for steel pipe and valves in the steam lines and sprinkler systems, steel framework for the heavy overhead doors, monorails for traveling hoists and timber connectors, you can hardly find any metal in the vast structures much larger than an ordinary size bolt.

The first buildings were placed under construction on June 30, 1942 and the factory proper on Aug. 24. Work was carried on through the following severe winter on a 24-hr. day, 7-day week basis, with substantial completion of all work under the original contract being accomplished

by the following April 30. The first section of the factory was turned over to the operators in November. An enormous construction crew necessarily was required to do so much in such a short time, the maximum employment peak reaching 8,500 workmen.

Unreinforced concrete

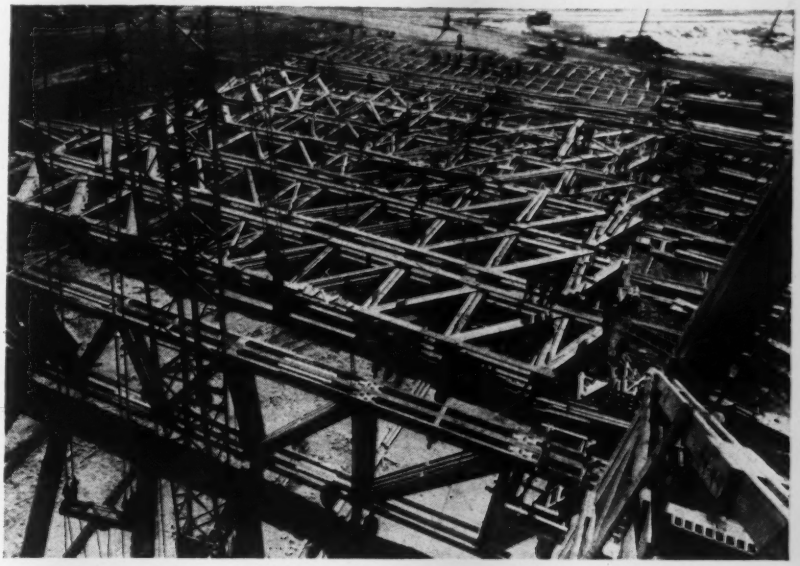
First construction operation was to grade the site and install drain lines of unreinforced concrete pipe instead of reinforced concrete or corrugated metal pipe usually specified for this purpose. An underground heating tunnel also was constructed leading out from the power house and encircling the construction area to connect with the various buildings. All parking areas, ground floors of the factory, hangar and auxiliary buildings, and the vast service area for planes are paved with unreinforced concrete. Most of the service area is surfaced with a 7-in. concrete slab, thickened to 10-in. at construction joints, and supported on a 16-in. gravel base. Part of the area, not subjected to heavy loads or vibratory action of planes during warming-up, is surfaced with 2-in. of asphalt on a 10-in. gravel base. Construction and expansion joints spaced 25 ft. each way throughout the factory floor have prevented settlement cracks.

Heavy timber trusses in factory

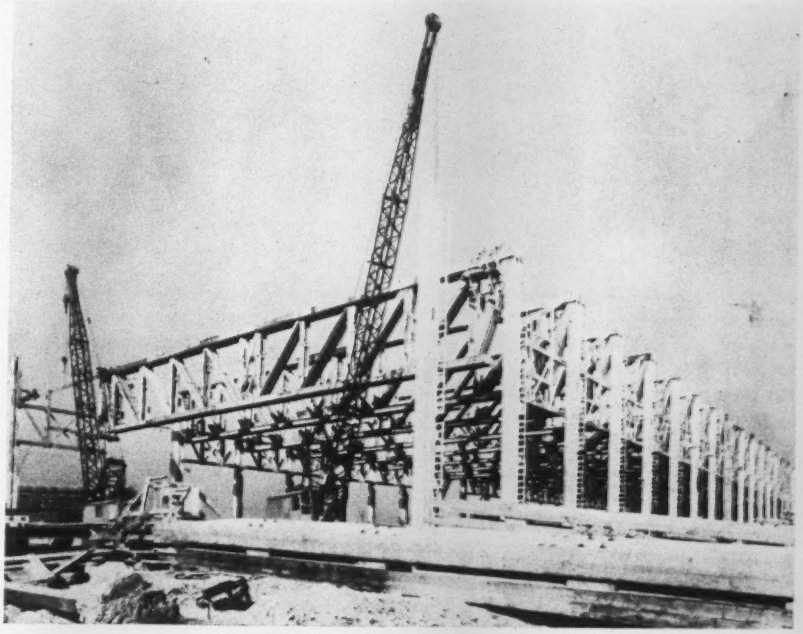
The functional requirements of the factory building called for the final assembly area to be spanned with 150-ft. trusses. These are of timber, framed into laminated timber columns. Inasmuch as the best structural grade timber ordinarily employed in a structure of this type was not available (only second grade or better fir and pine being obtainable) truss members in tension were designed for a stress of 1,200 lb. per sq. in. instead of the usual 1,600. This deliberate overdesigning of the structure was motivated by the uncertainties in the quality of the timber, augmented by the desire to insure absolute stability throughout the life of the plant. Curbstone guess of the engineers is that the wooden structure weighs about double and costs about ten percent above the same building designed in steel.

An estimated 20,000 tons of structural steel were saved by using timber trusses and columns throughout the factory building and hangar, and an estimated aggregate saving of 30,000 tons of critical materials was made throughout the entire plant by substituting timber and other noncritical materials whenever possible.

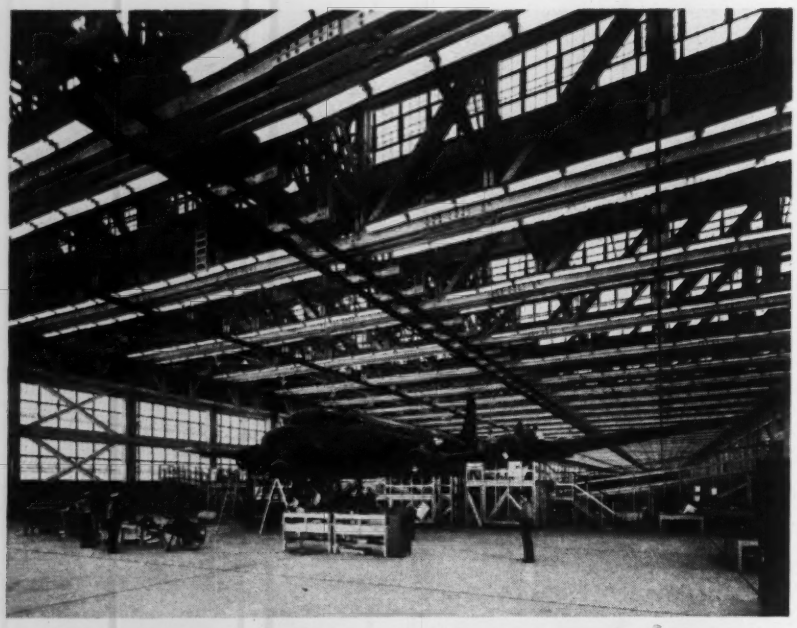
All timber trusses were fabricated on the job according to design plans, and inspection was made by the construction engineers. Some idea of the amount of lumber contained in one of the typical 72-ton, 150-ft. span trusses is visualized by noting the cross-sectional size of its members. The bottom chord includes one 8x18-in. and two 6x18-in. timbers; the top chord is made of one 8x20-in. and two 6x20-in. members; the end diagonals contain eight 3x12-in. boards and the larger vertical members utilize four pieces of 6x12-in. timbers. Trusses are of the Pratt type, 18 ft. c. to c. of chords, with diagonals and bottom chords taking tension, made possible only by employing timber

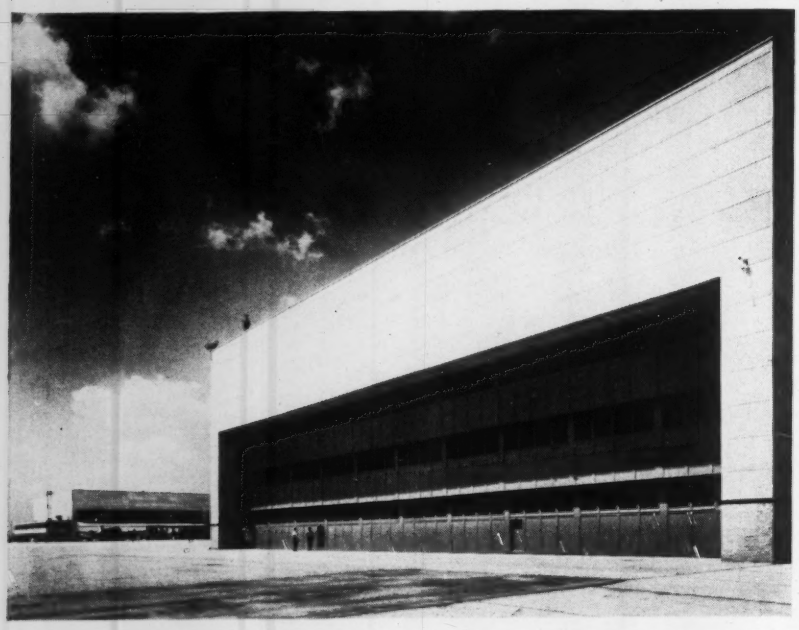


Complete fabrication of the timber trusses was carried out on the job. This view shows the successive stages in the assembly of the 150-ft. roof trusses.



Laminated timber columns supporting the 150-ft. trusses over the main assembly line are 54 ft. high. Columns are made of 2 posts bolted together, each post measuring 17½x34⅜ in. in cross-section.





Sawtooth roof construction, fluorescent lighting and a white concrete floor provided efficient lighting in the final assembly bay. Finishing touches are being made on a huge 4-motor Douglas C-54 cargo transport. Through this 150-ft. wide vertical lift door at the end of the assembly line, finished C-54's move out onto the service apron and to the hangars in the background.

connectors to distribute the stress at the panel points.

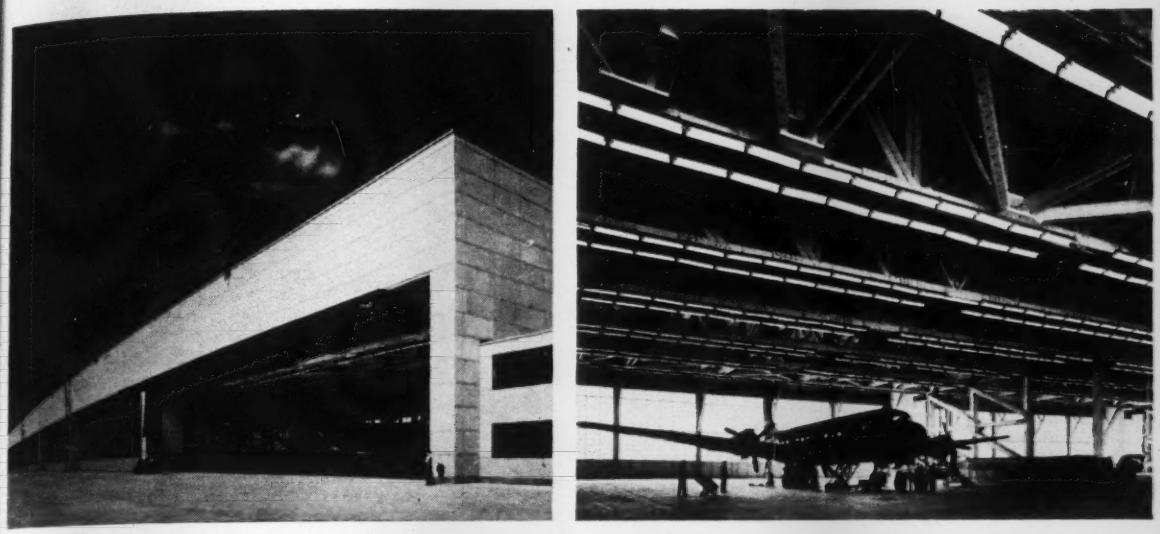
By fabricating the glued-laminated timber columns from 1-in. boards of varying short lengths, the use of large long timbers was avoided. As a matter of fact, such timbers were practically unobtainable during the short time allowed for completion of the plant. The largest columns include two built-up posts each measuring 17½-in. by 34⅜-in. by 54-ft. long. The posts are separated by timber blocks and bolted together to act as a unit for supporting the trusses. Column posts were laminated at the factory and fabrication completed on the job. Unreinforced concrete pedestal footings, supporting the columns, are carried about 8 ft. below ground where necessary to secure a good bearing. Footings usually are square, with some measuring 13 ft. each way to carry the heavy superimposed loads. They are stepped-up to form a column bearing area slightly larger than the over-all section of column.

Sawtooth roof construction and continuous wood-frame window sash containing heat-resistant glass provide ideal daylight working conditions inside the factory. A fluorescent lighting system throughout the plant maintains efficient around-the-clock illumination. It, alone, saved 132 tons of steel by utilizing pressed-wood reflectors with white enamel surface, instead of porcelain enameled steel. Copper wiring was reduced one-third by installing a modern distribution system. Bus ducts are supported on timber cross-pieces, and plastic covered power cables to machinery are supported on wooden arms hinged to posts. An estimated saving in copper sufficient to build 95,000 casings for 20 mm. cartridges and enough aluminum for 110,000 fuse primers was made by the use of a new double-duty lighting mechanism (4-lamp instead of 2-lamp ballasts) in the fluorescent fixtures. An 8-in. wall of common brick on concrete foundations supports continous bands of wood ventilating sash. This, together with the use of cement-asbestos insulated siding, gives the plant its striking modern appearance.

Roofing on both the factory and hangar is 3-ply, made up of a mineralized roofing surface carried on one-in. thick rigid insulation material, which in turn is supported on 2x6-in. planking. Light timber trusses, framed between the main roof trusses, support the roof. Vertical clearance of 25 ft. is maintained throughout the factory except in areas devoted to major subassemblies and final assembly work, where a 35-ft. height is provided. All timber truss work is painted with one coat of white resin emulsion cold water paint. This, together with the use of a white cement floor in the 150-ft. final assembly bay, greatly increases lighting efficiency.

Straight-line production

Taking advantage of experience gained from designing similar structures, the engineers built this huge factory so as to be highly efficient for straight-line production of the large transport planes. Two systems of steel monorails supported from the roof trusses by wooden hangars at the 28-ft. and the 35-ft. levels provide service



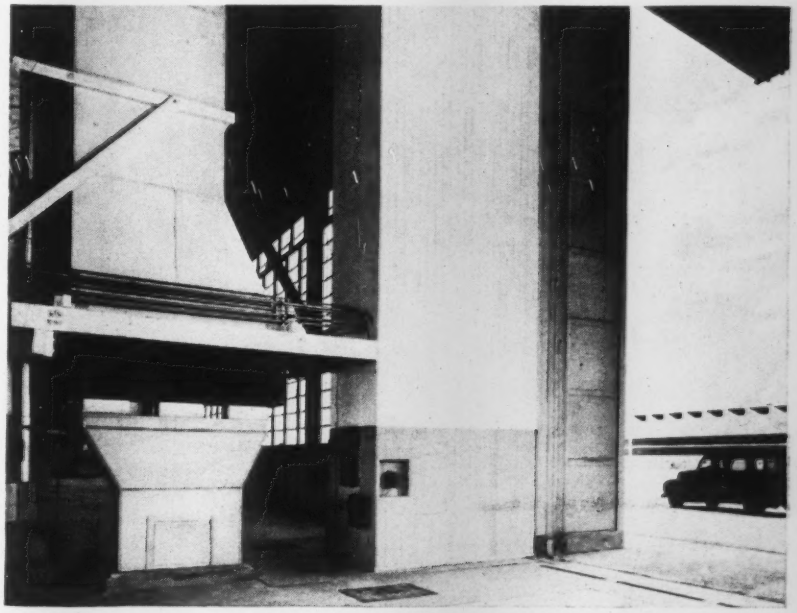
Counterbalanced, jackknife type canopy doors, 145 ft. long in the hangar can be opened to a 35-ft. clear height. Large timber diagonal braces absorb the operational thrust of the heavy doors, as shown in these exterior and interior views.

over 85 percent of the floor for 28 five-ton crane-hoists. Turntables located at various points in the monorail systems permit the hoists to travel at right angles, to any location desired. A firewall completely closes off sections devoted to the receiving and storage of material. Machine shops and sheet metal facilities, where smaller airplane parts are fabricated, plated, painted and assembled are adjacent to major subassembly areas. The huge wings and fuselages are assembled on jigs in parallel bays, and then are joined into a single unit on special-designed matching jigs at one end of the 150-ft. bay. At this stage of production the plane begins to move along the final assembly line. Tubing, tanks and motors are first installed; tail assemblies are attached, outer wings and propellers are added to complete the assembly, and the huge plane moves out onto the service area through a 150-ft. vertical lift door.

Explosive-proof paint shop

All painting is done in a building of timber construction having three 150-ft. doors; one on each side, and one in the middle dividing it into two sections. The plane, cleaned and prepared for painting in one section, is moved into the other, which is actually a huge spray booth equipped with explosive-proof fixtures. Stationary platforms in the paint shop provide access to all parts of the wings, while a hand-operated traveling overhead crane carries a framework, which when lowered, fits around the fuselage of the plane to facilitate painting. Powerful suction fans draw air into the spray booth through plywood diffusers and double fiber glass filters covering one entire wall, at the rate of 180 ft. per minute. The air passes out through a washing curtain of water on the facing wall. When planes leave this shop, their war paint complete, they are ready for testing, preparatory to actual service.

Six jackknife type, canopy doors are located along each side of the large hangar to permit access to the building by planes either from the service area on one side or the airfield on the other. Doors are 145 ft. long, and they can be opened to a 35-ft. clear height. Concrete counterweights balance the doors to permit their opening by electric motors operating a system of cables attached to the outside of the steel door frames.



Air is taken in from the upper portion of the hangar, passed down through unit heaters in the air ducts (painted dark) and forced up through floor slots just inside the doors to heat the building while doors are open. Concrete counterweight for door operation is enclosed in timber housing at the right of the air duct.

Electric and steam driven compressors in the boiler house provide compressed air throughout the plant. Timber trusses support the roof, and stiffening trusses with timber gusset plates provide rigidity along the walls. Even the grilles in the floor are timber instead of steel.

A rubber safety edge on the bottom of each door automatically stops its closing, on a very slight contact, thus eliminating any hazard to workmen.

Each door opening represents an area of 5,200 sq. ft., and the problem of heating this building during normal operations is solved by unit heaters installed between the door openings. When a door is opened, high velocity jets of hot air are released upward through floor slots provided along the length of each door. The air is taken from the upper portion of the hangar and heated as it passes down through the unit heaters. All-timber roof trusses are provided in the hangar, with each outside bay being rigidly braced horizontally to absorb the thrust induced from operating the doors.

Boiler house also required

Steam and compressed air required throughout the plant is furnished by a modern boiler house which is also of timber construction. Four boilers, each capable of producing 120,000 lb. of steam per hour are coal-fed from overhead concrete hoppers. Five compressors, four electric and one steam, produce compressed air needed in the fabrication, painting and servicing of the planes. Three reservoirs provide a 2-m.g. emergency water storage, one for domestic use and two for fire protection. Five pumps are housed in a fireproofed section within the boiler house, and there is an emergency steam-driven electric generator which provides power for lighting instantly in the event of a power failure.

All modern conveniences and healthful working conditions are furnished to employees, many of whom are women. The personnel building houses a fully equipped first aid and medical center. Included in the equipment is an operating room with static-proof floor and an X-ray room with light-proof curtains on the windows. Six doctors and 26 nurses are on the medical staff. Workmen are fed on the job at canteens located at various points in the plant or in staggered shifts in a modern cafeteria that has a seating capacity of 700. All are served from one large modern kitchen, hot food for the canteens being distributed from a point within the plant on portable trucks which also function as service counters.

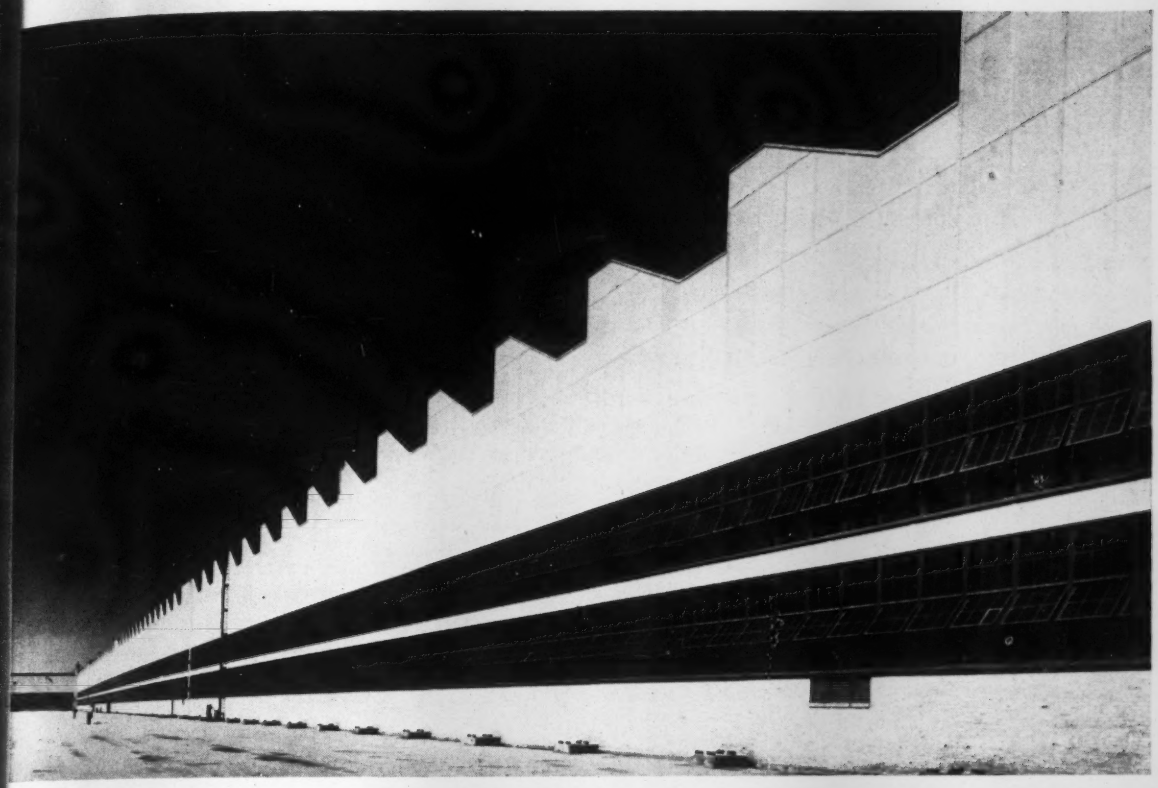
All construction of the plant was under the supervision of the Corps of Engineers, U. S. Army. The Austin Co., Cleveland, Ohio, prepared design plans and specifications under a fixed-fee architect-engineer-management contract. Engineering work required of The Austin Co. included not only the preparation of architectural designs but also the detail drawings for fabricating the timber trusses and columns. For this and other engineering on this project they had a peak employment of 187 men. Fabrication of all timber used on the job was by the Rilco Laminated Products Co. of Minneapolis, Minn., which handled 31,750,000 b. ft. of lumber in the complete fabricating shop set up on the site. The Austin Co. sublet various parts of the construction, such as the installation of the heating, lighting, plumbing and sprinkler systems.

All engineering work and construction was under the direct supervision of Albert S. Low, vice president and chief engineer of The Austin Co. Harold A. Anderson was chief designer and project engineer. The Army Engineers were represented by Col. C. Keller, district engineer, Chicago, and Maj. Wm. A. Bonnett, area engineer.

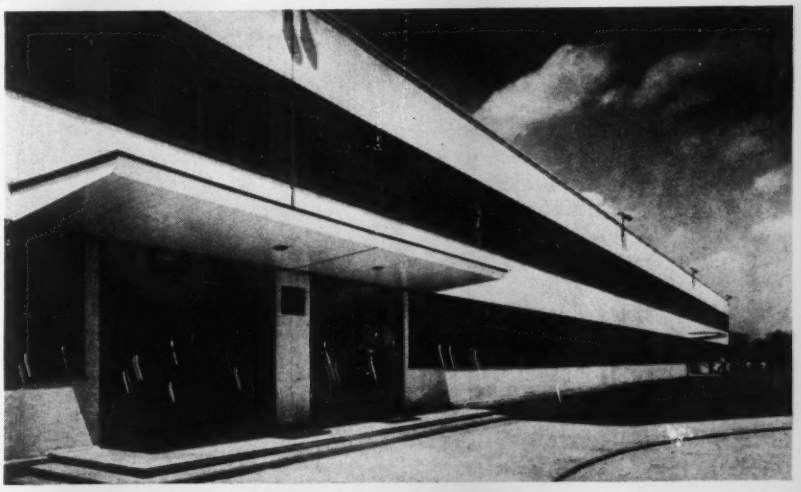
TABLE OF SUBSTITUTE MATERIALS USED

Substitute Material	Material Replaced	Approximate Amount Used	Approx. Unit Cost of Substitute Material	Approx. Unit Cost of Replaced Material
Timber framing, trusses and columns	Structural steel	13,750,000 b. ft.	$0.07 b. ft.	$100.00 t on
Wood floor grating in boiler house	Steel grating	1,400 b. ft.	.70 s. f.	1.00 s. f.
Masonite fluorescent lighting reflectors	Porcelain enamel reflectors	11,000	17.40 ea.	17.40 ea.
Masonite air ducts	Sheet metal ducts	130,000 s. f.	0.80 s. f.	0.60 s. f.
Fiber electrical conduit in floors	Steel conduit	75,000 l. f.	0.30 l. f.	0.40 l. f.
Fiber vent piping	Steel pipe	30,000 l. f.	0.14 l. f.	0.35 l. f.
Cement culvert pipe	Corrugated steel pipe	1,500 l. f.	1.80 l. f.	1.60 l. f.
Wooden file and storage cabinets	Steel cabinets	4,000	7.50 ea.	8.50 ea.
*Unreinforced concrete runways	Reinforcing bars			
Plastic pipe	Steel pipe	37,000 l. f.	1.54 l. f.	1.59 l. f.
Wood railings and tray-slides in cafeteria	Stainless or chrome plated steel	560 l. f.	4.00 l. f.	6.50 l.
Wood handrails on doors	Brass or chrome plated steel	150	2.00 ea.	3.00 ea.
Wood shades for windows	Sheet metal venetian blinds	1,100 s. f.	0.06 s. f.	0.12 s. f.
Fabric flashing	Galvanized iron	25,000 s. f.	0.12 s. f.	0.15 s. f.
Wood radiator housings	Cast iron	13,000 s. f.	0.35 s. f.	1.00 s. f.

*5,000 tons of steel reinforcement saved.

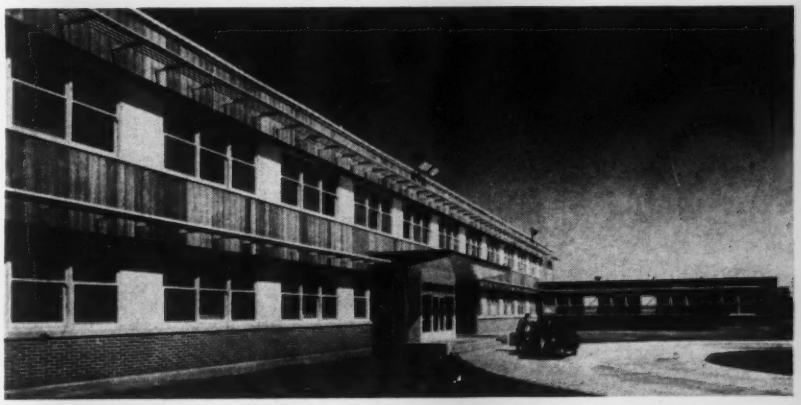


The designers of this mammoth aircraft plant have effectively combined brick, continuous bands of wood sash, asbestos cement siding and sawtooth roof construction in a striking facade in the best modern architectural manner. Ideal daylight working conditions and ample ventilation have been provided by the window treatment.



In the design of the administration building the same combination of wood sash and asbestos cement siding have been used. On the entire project about 30,000 tons of critical war materials were saved.

Personnel offices and a large medical department are housed in this brick and timber structure. Redwood siding has been used above first and second story windows, which are shielded from the sun by structural "awnings" of timber construction.



Resistance of Brick Walls to Wind

H. A. Sweet
Engineer, Associated Factory Mutual Insurance Co.
Boston, Mass.

***Contents in Brief**—After analyzing the stability of a 50-ft. high firewall that failed because of a 32-mph. wind, the author discusses the restrictions on firewalls in city building codes and makes known the inadequacies of these codes. By assuming a wall should withstand a given maximum wind velocity, studies are made as to the permissible ratio of height to thickness and as to when brick walls will crack. These studies indicate that the height of unbraced walls should not be more than ten times the thickness and that walls of tile have similar height limitations.*

REVISED ASSUMPTIONS on the wind resistance of brick walls have resulted from recent inquiries by the writer. Destruction by high wind of a brick firewall in a war building raised the question, since the maximum wind of 32 mph. reported as average velocity for a 5-min. interval, by the U. S. Weather Bureau, was only about one-half that expected necessary to destroy such a wall. In general, the writer's investigation revealed some major limitations on what constitutes safe design and resulted in some conclusions that should be of interest to designers and field construction engineers alike.

The 50-ft. high firewall that failed was 16½ in. thick for 40 ft. and 12½ in. for the top 10 ft. (Fig. 1). It was an east-west cross wall in a 200x740-ft. one-story building. The wall was unbraced, and there were no pilasters but the ends were well bonded to the much thicker exterior walls. The wall had three moderate doorway openings at floor level. The workmanship in laying the brick for the wall was excellent.

The wind that caused the failure was from the south and when the damage occurred the exterior walls of the building were 95 percent complete, but the roof framing and decking were not erected, nor were the windows and doors for the south exterior wall in place.

Calculated wall resistance

Much to the writer's surprise, calculations showed that the wall would tip over during a 26-mph. wind, which explained why the wall failed. The calculations for a 1-ft. length of wall were as follows:

Weight of Wall:

Top 10 ft., 120×10 = 1,200 lb.

Bottom 40 ft., $\frac{16.5}{12.5} \times 120 \times 40$ = 6,330 lb.

Total 7,530 lb.

Stabilizing moment about A (Fig. 1) = $7{,}530 \times 0.69 = 5{,}200$ ft.-lb.

Moment from Wind:

Total force = $50w$, acting at mid-height

Wind moment about A = $50w\ (25)$ = $1{,}250\ w$ ft.-lb.

Thus to make wall tip about A,

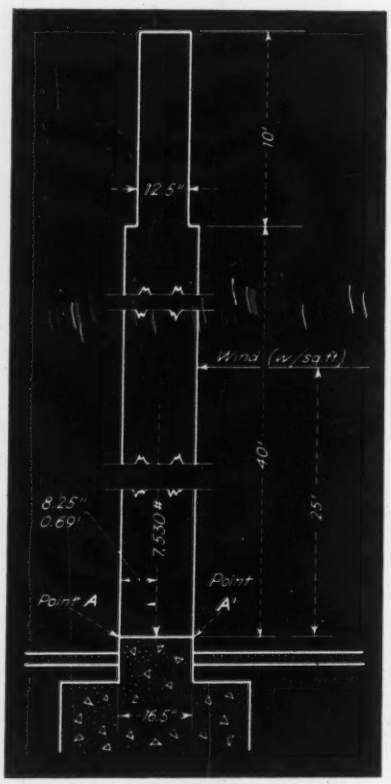


Fig. 1. Cross-section through wall that failed in a 32-mph. wind.

$1{,}250\ w = 5{,}200$ or wind pressure w = 4.2 per sq. ft.

From Fig. 2, which permits conversion from measured velocity to true velocity, a pressure of 4.2 lb. per sq.ft. would result with a wind of 26 mph. Prior to 1928, the Weather Bureau published 4-cup Robinson anemometer records; from 1928 to 1931 inclusive, 3-cup records, and since 1932, velocities corrected for instrument errors and called "true" velocities. Thus, use of the chart of Fig. 2 is necessary to obtain the correct pressure if the velocity is measured as the maximum for a 5-min. interval.

Building code restrictions

Because the velocity required to tip over the wall was so low, the writer next checked references in building codes to the limiting height of building walls during construction. The New York City building code proved to be one of the few containing such a provision.

The wording of that building code is as follows:

"C26-455.0 UNSUPPORTED HEIGHT OF MASONRY WALLS DURING CONSTRUCTION.—The maximum unsupported height of any masonry wall during the period of construction shall be two stories or 26 ft., unless satisfactory support is provided and specific approval of the superintendent obtained, except when walls are carried separately by structural members on each story."

As a further study of the code, which does not take into consideration wall thickness, the author calculated what velocity a wall 26 ft. high and of 16.5-in. uniform thickness could withstand. These calculations were made about a point corresponding to Point A in Fig. 1 and were as follows:

Weight of wall = $\frac{16.5}{12.5} \times 120 \times 26$ = 4,120 lb.

Stabilizing moment about A = $4{,}120 \times 0.69 = 2{,}840$ ft.-lb.

Moment from a wind pressure of X lb. per sq. ft. about A = $(26X)\ (13)$ = $338X$ ft.-lb.

For wall to tip about A, $338X = 2{,}840$ or $X = 8.4$ lb. per sq. ft. The corresponding velocity from Fig. 2 is 38 mph.

If the New York City code had been followed, it would have been necessary to brace the actual wall laterally when a height of 26 ft. was reached. Even then the remaining height of 24 ft. would have been unable to resist a wind over about 38 mph.

The author's continued study revealed that many building codes limit the unsupported height of walls to twenty times the thickness of the wall. This provision is inadequate, before the roof is installed, and such codes were probably prepared for completed buildings with the wall braced laterally by the roof and floors. Thus, these codes are satisfactory only for the finished buildings.

Wind necessary to crack wall

Next, studies were made of the force necessary to crack a wall. In this work it was assumed that for a brick wall to tip over, the bond between the mortar and bricks must fail. The modulus of rupture of ordinary commercial brickwork with cement-lime mortar, was taken as 31 psi., or that reported by the National Bureau of Standards *Building Materials and Structures Report* BMS 5, Nov. 21, 1938, as the average for three walls. Using this value the author made calculations of the necessary wind velocity to crack the wall of Fig. 1. These calculations showed that a 22-mph. wind would break the bond on the windward side of the 50-ft. wall shown in Fig. 1. The calculations were made as follows:

Stress at A due to wall's weight

$$= \frac{7.530}{12 \times 16.5} = 38.0 \text{ psi.}$$

Modulus of Rupture = 31.0 psi.

Unit stress at A to cause cracking = 69.0 psi.

Moment at A due to wind w = $\frac{w\,(50)^2}{2}(12) = 15{,}000\,w$ in.-lb.

Section Modulus $\frac{12\,(16.5)^2}{6} = 544$

Wind causing cracking at A′ = w

$$= \frac{(544)\,(69)}{15{,}000} = 25 \text{ lb./sq. ft.}$$

Corresponding wind velocity from Fig. 2 = 22 mph. (5-min. average)

It is the belief of the writer that a wall should be stable during a wind of at least 67 mph. or a wind pressure of 20 lb. per sq.ft., as shown by the dash line in Fig. 2. If a wall is designed for this pressure the height

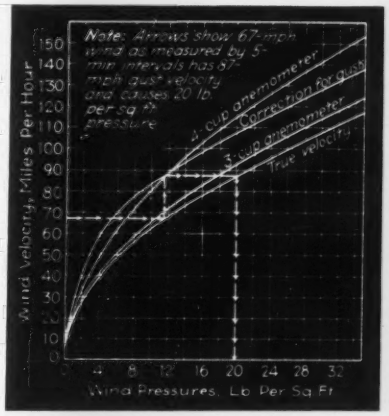


Fig. 2. Chart for calculating pressure on wall when wind velocity is known. Because Weather Bureau ordinarily reports velocities as average for 5-min. intervals, this chart should be used to obtain true maximum velocity of gusts.

of the wall should not be more than ten times the thickness; the wall which failed had a height of 36 times the thickness. With a wall where the height-to-thickness ratio is not greater than ten, the rupture resistance instead of the tipping resistance limits the height. Although the tipping limitation on height is only eight times the thickness, the wall will not tip until it has cracked along the windward side.

The calculations of the limiting height of 16.5 in. thick brick wall to resist a 67 mph. wind were as follows:

Height limitation for rupture resistance:

Maximum unit stress due to bending

$$= \frac{20\,H^2\,(12)}{2\,(544)} = 0.22\,H^2 \text{ psi.}$$

Modulus of Rupture = 31.0 lb./sq. in.

Unit compression due to wall's weight

$$\frac{158.4\,(H)}{12\,(16.5)} = .80\,H \text{ psi.}$$

Thus, $0.22\,H^2 = 31.0 + .80\,H$ or $H^2 - 3.64\,H - 141 = O$ and $H = \frac{3.64 \pm \sqrt{13.2 + 564}}{2} = 13.8$ ft. or 10 times the thickness.

Height limitation for tipping at A:

Overturning wind moment

$$= \frac{20\,H^2}{2} = 10\,H^2$$

Stabilizing weight moment = $158.4\,H\,(0.69) = 109.2\,H$. So $10\,H^2 = 109.2\,H$ or $H = 10.9$ ft. or 8 times wall thickness

Conclusions and recommendations

From these studies certain general conclusions and recommendations can be made. These conclusions include:

1. Exposed and unbraced brick walls higher than ten times their thickness are not stable during maximum probable windstorms until the roof or floor construction is securely attached to the wall. Conservatism, to take care of some deficiencies of workmanship, would dictate a moderate factor of safety and limiting the height to eight or nine times the thickness.

2. To guy or shore temporarily a long high wall, which will later be braced by the roof, is not believed practicable.

3. Building codes should include provisions to guide the engineer or contractor during construction of brick walls so that windstorm damage will not result. It does not appear practicable to design a wall to withstand the extremely high velocity found in the vortex of a major tornado.

4. Walls of tile and concrete blocks should also have height limitations, although not quite the same as for brick walls.

Improved Tensile Test Method for Concrete

As improved method for testing concrete in tension has been developed at the National Bureau of Standards by Louis Schuman and John Tucker, Jr. Cylindrical specimens, 4 x 16 in. are used, and the loads are applied through threaded rods embedded in a rich mortar at the ends of the specimens.

The new test requires less complicated apparatus than other methods of tensile tests, and uses smaller cylindrical specimens. It is believed the new test specimens give a better test because the distribution of stress across the break is more uniform.

Tests made with the new apparatus disclose that: Cements of the moderate-heat type give but slightly lower compressive and tensile strengths at early ages than normal portland cements. At later ages they often give higher strengths, both in tension and compression. High-early-strength cements give appreciably higher strengths at early ages than the other types of cement. The use of either a high-early-strength cement, or of a richer mix with a normal cement, appears to have greater advantages in securing hig hearly tensile strength than it does on high early compressive strength.

Fig. 1. Laminated arches for modification center hangars** were erected by **two cranes with 75-ft. booms. Arch being raised is of 177-ft. span and of 7½x39¾ in. cross-section.

Long-Span Arches for Modification Center

***Contents in Brief**—An airbase modification center required eight hangars arranged in two rows of four each and separated by shops, plus an office building at each end parallel to the hangars. For six of the hangars, 157-ft. laminated timber arches on 10-ft. centers were used and for the other two, similar 177-ft. arches were erected on an equal spacing. All the arches are supported on unreinforced foundations and no ties are employed below the floor. Both shops and offices are two stories in height and of timber-frame construction.*

WHAT ARE BELIEVED TO BE some of the longest laminated timber arches ever erected have been installed at a Midwest airbase modification center. In addition to the long-span arches, the project is of interest because of the arch foundations, layout of the center, the limited use of critical materials, and the construction procedure followed.

Planned for modification and repair of large aircraft, the center includes eight hangars in two north-south rows of four each. The two rows are separated by 66-ft. wide two-story, timber-frame shops and about 60 ft. away from the hangars both to the north and south is a 48x134-ft., timber-frame office building (Fig. 2). This layout not only permits a maximum flexibility in the use of the hangars, but it places the shops at a point where they will be easy to heat and convenient to all the hangars. Also the office buildings are so located that the office workers are not disturbed by shop noises. Neither do these structures interfere with aircraft using the hangars.

Because construction of the hangars was considered a longer and more difficult job, they were started first. They are each 120-ft. long and those at the north end have laminated timber arches of 177-ft. span on 10-ft. centers. The arches for the other six hangars are of 157-ft. 6-in. span and on the same spacing.

All the arches, of elliptical shape, were fabricated of 1x8-in. structural fir lumber and casein glue. The 177-ft. members, which are 7½ in. wide and 39¾ in. deep, are curved to a radius of 132 ft. at the crown and to a 43-ft. 9-in. radius at the ends. The smaller arches, also 7½-in. wide, are 33½ in. deep, and curved to radii of 121 ft. and 36 ft. 10 in., respectively.

Foundations of plain concrete

Arches for neighboring hangars have common concrete foundations of the type shown by Fig. 3. The only steel in the concrete is the four 36-in. long, ¾-in. dia. anchor bolts at each bearing. The foundations incorporate a 12-in. wide continuous longitudinal wall that supports an equally thick cinder-block firewall between the hangars.

To carry the thrust of the arches steel ties are not used at floor level between foundations at opposite ends of the arches. Instead, the footings were sloped to make the bearing area on the underlying soil, which was a loam permitting a bearing pressure of 4,000 lb. per sq.ft., perpendicular to the direction of the load (Fig. 3).

Construction of the foundations was started December 31 and continued during a severe winter. The concrete was delivered by agitator trucks, and not only was both water and aggregate for the concrete heated, but the concrete in place had to be protected with tarpaulins and sala-

manders. In addition, the mud was often so bad that the transit-mix trucks had to be pulled to the desired location by bulldozers. Furthermore, to thaw the frozen ground to permit the required excavation was often necessary. The footings and the dividing wall were poured monolithic in 20-ft. lengths.

Arches delivered in three sections

Erection of the arches followed closely behind the foundation work and before the floors were built. The arches of 177-ft. span were delivered in three sections of about equal length and assembled on the ground. To splice two sections a 7x½-in. steel plate 7 ft. 8 in. long was added at top and bottom and two 10x½-in. plates 5 ft. 3 in. long at either side, plus a 3x6-in. timber of about 8-ft. length near the top on each side.

To raise a full 177-ft. arch, which has a rise of 57 ft. above floor level, a truck crane and a crawler crane, both with 75-ft. booms, worked together (Fig. 1). The arch was raised by hitches at the two splices. During this operation the arches were not strengthened other than by the splice plates and timbers mentioned. In an 8-hr. day the two cranes erected two to four arches complete with bracing.

Before the next arch was erected, the required bracing between the one last raised and those already in place was added. The bracing consisted of timber box and I-shaped struts plus a few ¾-in. dia. steel diagonals of the type and spacing shown by Figs. 5 and 7. Each box strut was made up of two 2x10's and two 2x12's. They were supported at each end by two 7"x3½"x⅜-in. angles and ⅞-in. bolts. The I-struts consisted of a single 2x10-in. timber and two 2x12's, and they were held in place by angles of the same size.

End arches stiffened

To erect the arches of 157-ft. span, which were also delivered in three sections, the same equipment was used and the same methods followed. Erection of the 104 arches required for the eight hangars was started January 22 and was completed March 13. Once in place, the last arch at the outer end of each hangar was stiffened for about 20 ft. above floor level at each end to better withstand the wind loads from the large doors. This stiffening consisted of adding on each side of the rib two 2x12's held in place by ¾-in. bolts on a 15-in. spacing.

To provide additional bracing against the large wind load going into the end arches from the doors, bracing of the type shown by Fig. 9 was used. It is to be noted that the heavy timber bracing extends from the first arch back to the second and third ribs. To close the area above and to the side of the doors 1x6-in. sheathing and asphalt strip shingles were added over the vertical posts in the plane of the first arch.

The doors at the outer end of the hangar were of two types. With the larger hangars, sliding doors of steel construction supported on a steel rail at floor level were used to provide an opening 150 ft. wide and 24 ft. high.

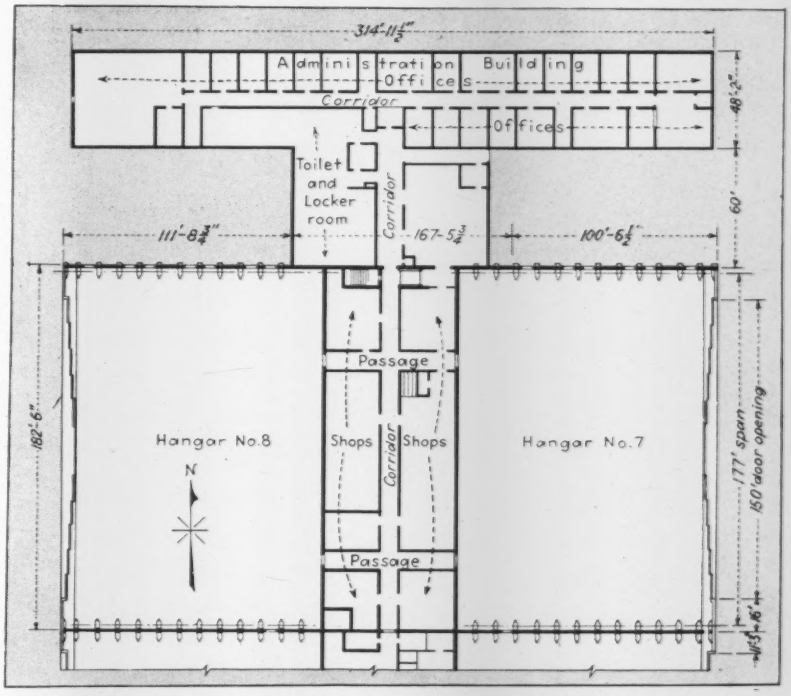


Fig. 2. Modification center consists of eight hangars in two north-south rows with shops between and an administration building at both the north and south ends. The other six hangars, although of but 160-ft. span, are similar to the two shown. Second office building is of same size as that illustrated.

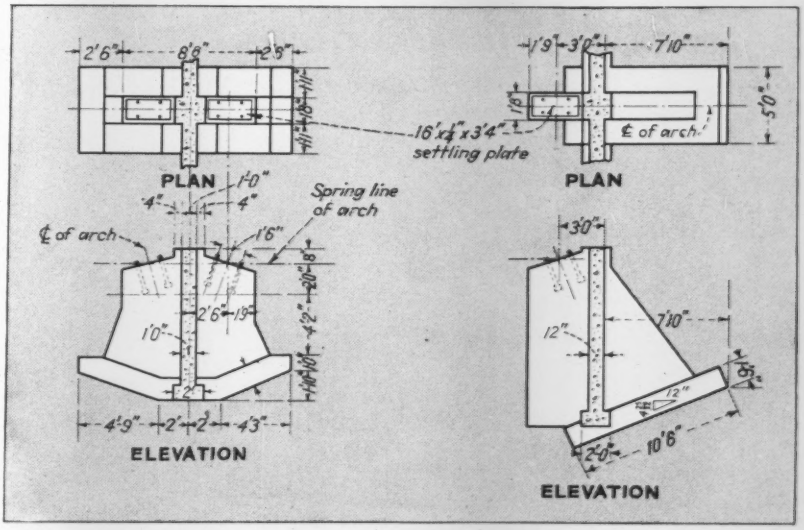


Fig. 3. Neighboring hangars have a common, plain concrete foundation of type at left. Exterior foundations for hangars are of type at right.

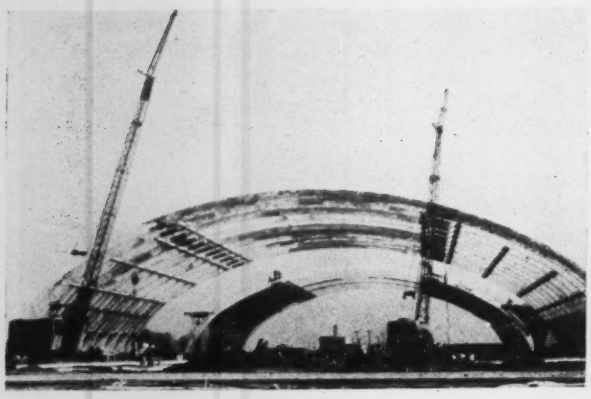


Fig. 4. Two cranes completing erection of the 177-ft. span arches for the two 120x180-ft. hangars.

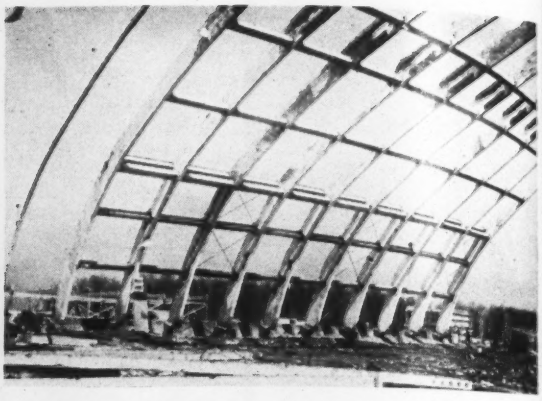


Fig. 5. Bracing between arches consists of timber box and I-shaped struts, plus a few 7/8-in. dia. steel diagonals.

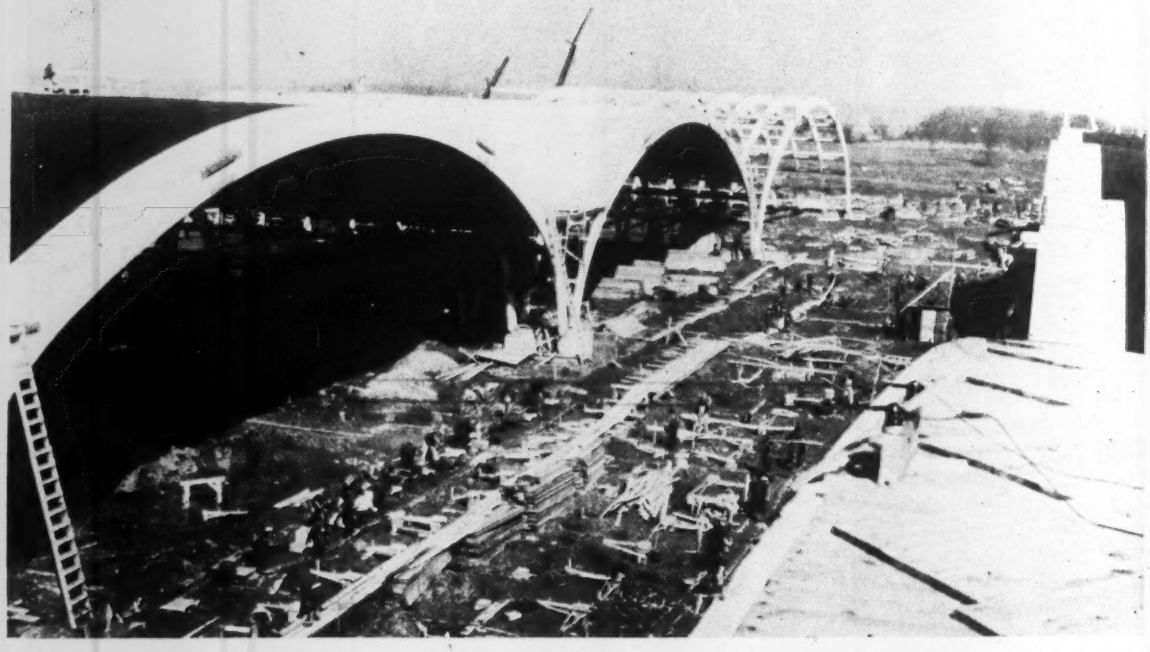


Fig. 6. As two rows of hangars neared completion, construction of foundations for the intermediate shops were started.

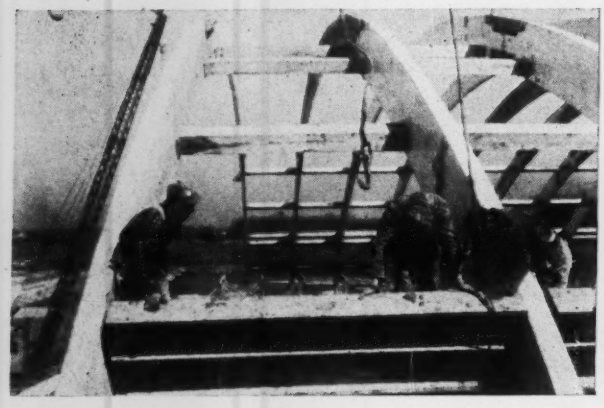


Fig. 7. Struts were raised by cranes and bolted in place as each arch was erected.

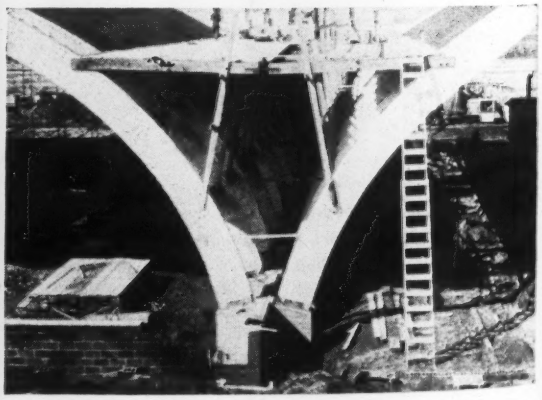


Fig. 8. Neighboring hangars have a common, plain concrete foundation. Later a firewall was built between hangars.

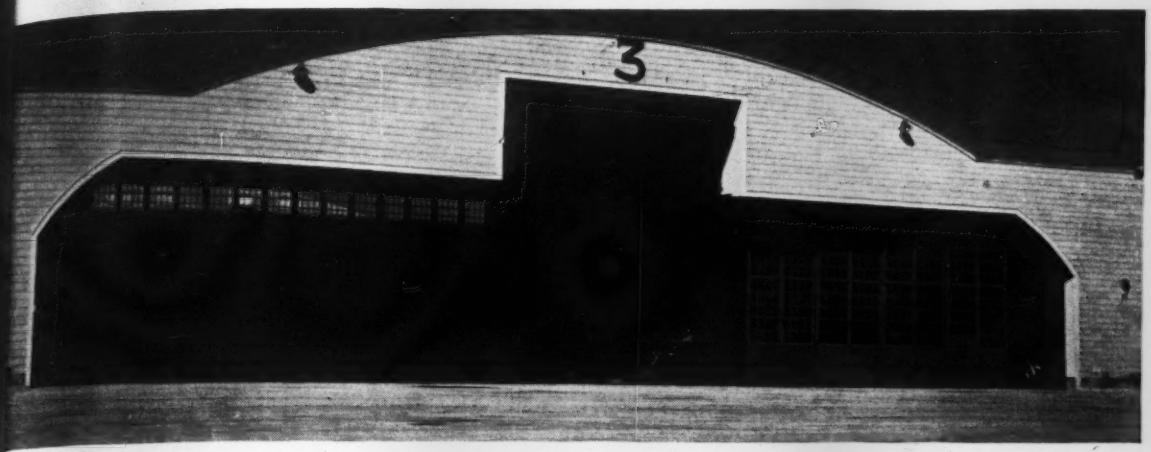


Fig. 9. Entrance to one of the small hangars. Lower opening measures 24 x 140 ft. and top "tailgate" door 11 x 32 ft.

These doors were fabricated in vertical leaves 12 ft. 8 in. wide and their operation is aided by reinforced-concrete counterweights suspended at each side.

To provide additional vertical clearance at the center of the hangar, a 13x42-ft. steel roll-up door known as the "tailgate" door was installed. Operated by a small electric motor supported in the arch ribs, this door provides a maximum vertical opening of 37 ft. for the larger hangars. Doors for the 160-ft. hangars are of similar construction but smaller in size, the lower opening measuring 24x140 ft. and the top 11x32 ft.

The roof at the outer end of the hangars was not added until the framing and bracing for the doors were in place. The roofing consisted of 2x6-in. planking covered by 1x6-in. diagonal sheathing and 4-ply, built-up roofing.

After construction of the hangars was well advanced, work was started on the 48x314-ft. southern administration building, which contains a control tower at the southwest corner. This office parallels the hangars 60 ft. to the south and is joined to the hangars by a 13-ft. wide corridor. Of two-story height, the building has a timber frame, cinder-block walls and a built-up roof. An 8-ft. wide corridor runs the length of each floor and the column spacing is 10 ft. by 13 ft. 8 in. in the offices at each side.

The 66-ft. wide shops between the two rows of hangars are likewise of two-story height and of similar construction. Here, a central longitudinal corridor is provided, also the width of the passageway being 9 ft. 8 in. (Fig. 2). Two transverse passages between each pair of opposite hangars are provided through the shops at the first floor level. The column spacing in the shops is 10 ft. in the longitudinal direction and 13 ft. 7 in. in the transverse direction. The shops have cinder-block side walls.

Construction of the 48x314-ft. office to the north was the last structure to be started. This building is similar to the south administration building, although it does not incorporate a control tower. Major distinguishing feature of the offices was the limited use of critical materials.

The work described was carried out by the Corps of Engineers, U. S. Army, under the general supervision of Colonel Charles L. Hall, division engineer, Ohio River Division, and Lt. Col. Edwin C. Landberg, district engineer. Major Perley M. Lewis, area engineer, and Captain R. B. Prinz, executive officer, were in direct local charge of the project.

J. H. Marshbank Construction Co., Chicago, with Joseph Kauhl, general superintendent, and Joseph Boren, in charge of hangar erection, built the hangars, shops, and offices.

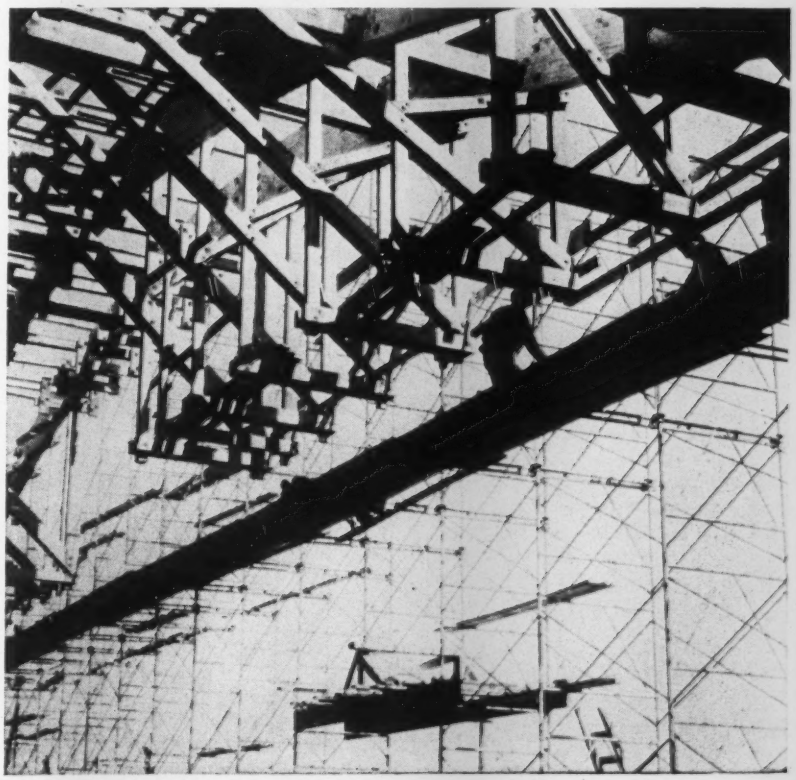


Fig. 10. At outer end of hangars heavy timber bracing was added to carry wind loads from the high doors.

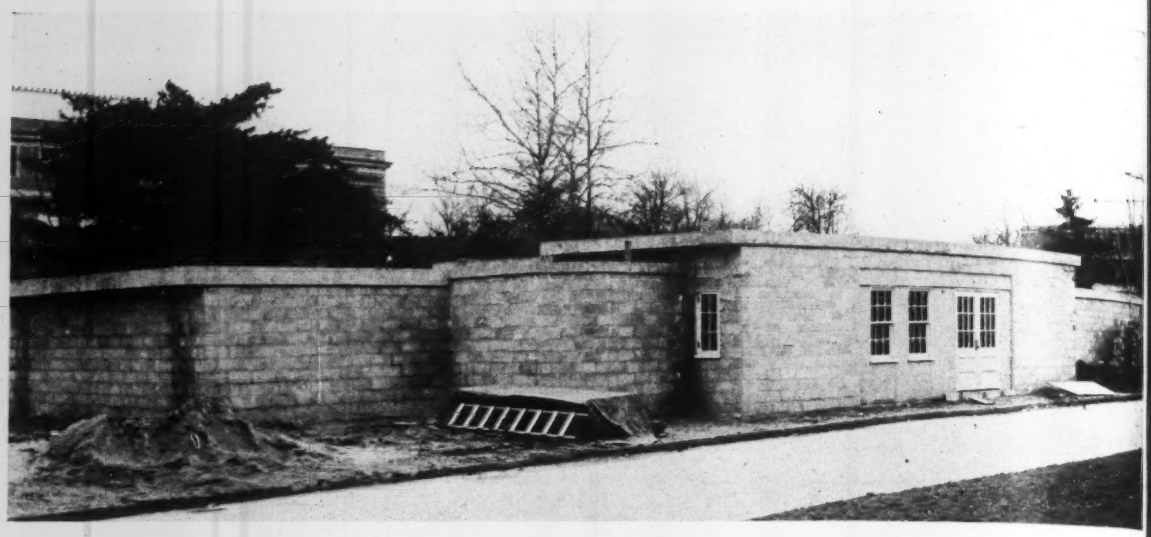


Fig. 1. Housing high-voltage X-ray equipment, this research building has walls of special construction requiring no lead.

Earth-Filled Walls for X-Ray Building

***Contents in Brief**—A research building recently completed at Ohio State University to house a 20-million-volt betatron and a 3-million-volt electrostatic generator has thick earth-filled concrete-block walls around the X-ray equipment, instead of the more normal sheet lead protection.*

FOR A NEW RESEARCH LABORATORY at Ohio State University, Columbus, Ohio, thick, earth-filled concrete-block walls are used to shield operators of X-ray equipment, and the public, instead of thick layers of lead used normally for such purposes. Because of the high frequency of the equipment, the lead lining of rooms housing the machines would have had to be 12-in. thick, which meant that several tons of that critical material would have been required. Alternatives considered and rejected as less desirable or more expensive than the earth-filled concrete walls were housing the equipment below ground, or housing it within solid concrete walls of sufficient thickness to give protection against the X-rays.

Known as the electrostatic generating station, the building is one story in height and for the most part windowless. Foundations are spread footings, floors are plain concrete slabs, walls, other than the earth-filled ones, are simple concrete block, and the roof is a concrete slab covered by built-up roofing. The structure houses two experimental rooms, an operator's room, a waiting room, and two small offices.

The smaller of the two experimental rooms will house high-frequency X-ray equipment operating at 20 million volts and the larger room will contain an electrostatic generator operating at 3 million volts. Intensity of the radiation is such that the rays had to be confined to rooms where the equipment is used.

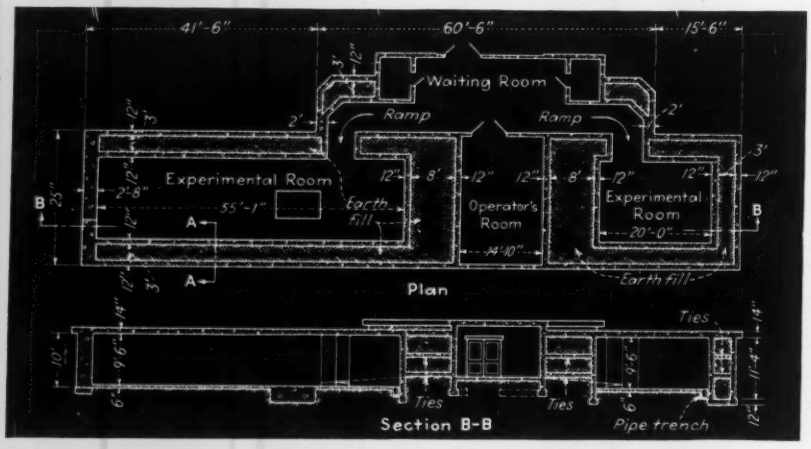


Fig. 2. The experimental rooms are insulated by earth-filled concrete-block walls having a minimum thickness of 5 ft. Twice this amount of protection is afforded the operators who must be in the building for long periods during test runs.

Earth-filled walls

The earth-filled walls around the two rooms housing the X-ray equipment have a minimum thickness of 5 ft. The inner and outer faces of these walls are of concrete block 1 ft. thick. Between these faces 3 ft. of earth fill was added. Since the operators are to be in the neighborhood of the equipment for long periods, they are given greater protection, the walls separating their room from the equip-

ment being 10 ft. thick. Entrances to the rooms housing the equipment are shielded by earth-filled walls, as shown in Fig. 2.

The walls are supported on continuous spread footings made of plain concrete to save steel. They are tied together by 8x8-in. reinforced-concrete ties on about a 4-ft. spacing both ways. Cells in the concrete block were filled solidly with mortar.

Other than the 12-in. long rods at the top and bottom of the walls to tie them to the roof slab and footings, and four ⅜-in. round rods in each concrete tie, no reinforcing steel was used in the walls.

After the concrete-block walls had been carried to their full heights, the earth fill was added with a clamshell bucket handled by a truck crane. Ordinary earth in a fairly dry condition was used. It was compacted in place by hand.

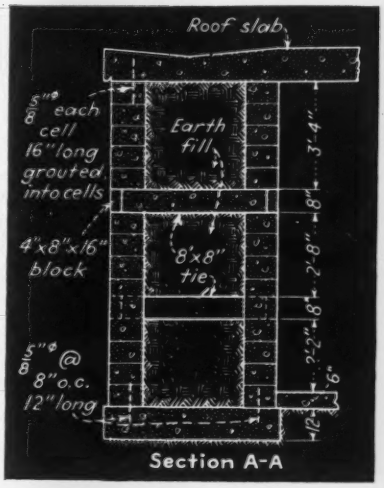


Fig. 3. Double concrete walls with earth fill are tied together on a frequent spacing by 8x8-in. concrete ties, each reinforced by four ⅝-in. round bars.

Special observation windows

To permit the operators to observe the progress of test operations without entering the experimental rooms, observation windows of a special type are built into the walls. Each window consists of a 4-in. dia. pipe closed at each end with a ½-in. thick plate glass plug and filled with clear water. Thus, the operator may observe the experiments through a 10-ft. thickness of water.

A number of openings through the walls had to be provided for water pipes and electrical conduits. All are laid out with elbow turns that eliminate direct openings from the experimental rooms to other parts of the building or to the outside.

The roof consists of a 12-in. reinforced-concrete slab covered by a 3-ply, built-up roofing. After the roof had been completed the exterior walls were given two coats of waterproof tinted stucco. Inner faces of the walls were left unfinished.

The building was built by Ohio State University at a total cost exclusive of equipment of about $13,000. Howard Dwight Smith, university architect, prepared the plans and his office supervised construction. The Trapp Carroll Co., Columbus, Ohio, with Henry Donald superintendent, was the general contractor.

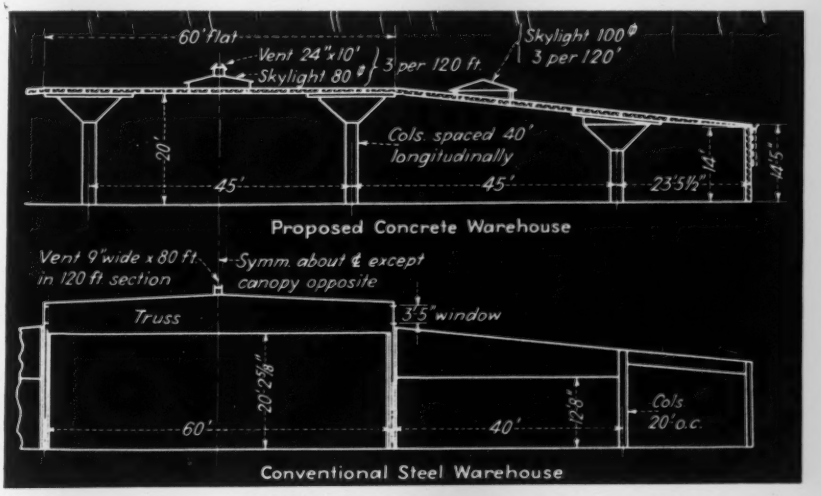
Flat-Slab Concrete Roof Found Economical

Jacob Feld
Consulting Engineer, New York, N. Y.

ESTIMATES OF COST of construction of comparable designs of warehouses for standard steel, concrete barrel-arch and concrete flat-slab roof showed the latter somewhat less in cost. This verifies and extends the cost analyses of Arthur F. Comstock's article "Cost Comparison of Wood, Steel and Concrete Warehouses" (*ENR* April 22, 1943, p. 626) in which is given the comparative cost of wood, steel and concrete single-story warehouses, for a width of 181 ft. 8 in. and the thin barrel-arch roof design as the example of comparative concrete structure.

About two years ago bids were taken by the Quartermaster General's office for 14 warehouse buildings designed with steel truss roofs, with alternate bids asked on concrete structures of the same size, volume and capacity, and with equivalent natural light and ventilation. At that time the writer prepared a flat-slab concrete design, which, in accordance with the estimate of his client, Psaty & Fuhrman, Inc., seemed more economical than either the steel or the barrel-arch concrete design. The proposed design in addition to economy, had certain bomb-resistant advantages. Comparison was made at labor rates prevailing in February 1941 in Georgia.

General feature of the reinforced concrete flat-slab roof design was support on reinforced concrete col-



Concrete flat-slab roof warehouse designed to be the equivalent in space, clearance and lighting of the steel building below. Design studies showed top layout required less steel.

COMPARISON OF SQUARE FOOT COSTS OF THREE TYPES OF WAREHOUSES IN DOLLARS, INCLUDING ALL SITE WORK:

Bidder	Standard steel design	Barrel arch design	Flat slab design
A	2.065	.....	.....
B	2.225	2.126	.....
C	2.168	2.282	2.134

The comparison of unit costs per sq. ft. for the two concrete designs (as estimated by bidder C) were:

Item	Barrel arch design	Flat slab design
Excavation	0.063	0.069
Electrical and mechanical	0.817	0.815
Foundations, etc	0.482	0.505
Superstructure	0.920	0.745

The proposed flat-slab design required the least amount of steel, as is shown by the comparison for the three designs:

Item	Standard steel	Barrel arch	Flat slab
Structural	10,866 ton	300 ton	300 ton
Floor mesh	720	720	720
Reinforcing	1,470	7,175	6,405
Totals	13,056 tons	8,195 tons	7,425 tons
Per sq. ft	12.50 lbs.	7.85 lbs.	7.10 lbs.
	176%	110%	100%

umns spaced generally 45 ft. apart across the building and 40 ft. apart longitudinally. The roof slab between the sidewalls and the first interior columns was designed as a cantilever projecting from the main slab. In this design exterior walls were to be of brick or concrete and did not serve as bearing walls.

Skylights at 40 ft. c. to c., in three lines across the building, took the place of continuous monitor fixed lights of the original design. Area of glass and distribution of light was maintained and former ventilation was replaced by equivalent ventilation in the middle line of skylights. For more complete protection in case of an emergency, the skylights might be replaced by steel covers without any change in the structural details.

No exposed columns at walls

The alternate design of roof construction permitted the elimination of the exposed columns on the exterior wall line, thereby allowing unobstructed use of driveways at the truck-loading areas. Fire walls, at the same locations as in the original design, were carried to the underside of the roof slab and they had a curb projection at the expansion joints.

In preparation of the alternate design, the recommendation of British engineers for bomb-resistant construction were followed: Bearing walls were eliminated; large areas of glazing were avoided; a rigid frame design was used, trying the roof to the supports; and heavy roof slabs were provided.

The detailed design was prepared in accord with the requirements of "Report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete," dated June 1940.

The total floor area of the 14 warehouses was 2,090,000 sq. ft. Unit bids per square foot of floor area of the three lowest bidders and detailed costs and material analyses for the structures are shown in the accompanying tables.

Units shown are based on interior floor areas, although costs and steel requirements include a 16 ft. wide platform and canopy along one side of each building, and three areas totalling 65,000 sq. ft. of supported floor, where low-bearing-value soil existed.

Higher foundation and excavation costs of the flat-slab design are caused by the greater dead weight, but this is estimated to be more than compensated by the savings in labor costs of concrete forms and placing reinforcing steel.

ENR Staff Photo

British warehouse of reinforced concrete which complies with bomb-resistant principles mentioned in the article. Design is unusual in that the heavy roof slab, located at the bottom of the supporting girders, is cantilevered (and bent upward 45 deg.) into the center aisle to support precast concrete gable frames that contain the skylights. The building is used for fuel storage at one of our depots in England.

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

AIRPORT PAVING AND DRAINAGE WOODBINE, N. J.

OWNER: Civil Aeronautics Administration, First Region, LaGuardia Field, N. Y.

PROJECT: Clearing, grubbing, grading, draining and paving the Woodbine, N. J. Airport, consisting of clearing, grubbing and grading portions of the entire airport area, placing field and outfall drainage constructing drainage and placing 7-in. concrete pavement for three runways 2,500 ft. long by 150 ft. wide, together with necessary taxiways and apron, and other appurtenant work.

CONDITIONS: Contractor to furnish all materials and complete work on Schedule I in 45 calendar days and work on Schedule II in 40 calendar days. Railroad and highway transportation facilities available. Rider on wage rates not yet issued, but contractor is to pay prevailing wages to all classes of labor.

BIDS: Thirteen bids were received August 27, 1943 on Schedule I, ranging from the contract low of $215,699 to $313,967. Engineers estimate, $246,867. On Schedule II, fifteen bids were opened on the same date, ranging from the contract low of $353,000 to $473,000. Engineers estimate, $375,500. Two bidders submitted identical low bids for Schedule II, $353,000. But as one was the low bidder on Schedule I, the award was to them. Award total for combined schedules is $568,699.

Schedule I—Preparation of Site

LIST OF BIDDERS:

1. The Grandview Co., Mt. Vernon, N. Y. (contract) $215,699
2. Peter Mitchell Inc., and Paul Bacco & Sons, Inc., Greenwich, Conn. 218,874
3. Harry Eisenberg, Inc., Westmont, N. J 232,597
4. John Arborio, Inc., Poughkeepsie, N. Y 237,669
5. Frank Stento & Sons, Binghamton, N. Y 243,612
6. Spiniello Constr. Co., and Joseph Nesto & Co., Newark, N. J 261,210
7. Robert W. Cleveland & Co., East Orange, N. J 275,155
8. Woodcrest Constr. Co., Inc., and Rosoff Bros., New York, N. Y 286,799
9. Central Pennsylvania Quarry, Stripping & Constr. Co., Hazleton, Pa. 289,796
10. Edward Acker Co. & Tuckahoe Constr. Co., Tuckahoe, N. Y. 290,402
11. Triangle Contracting Co., Newark, N. J 298,366
12. Michael J. Terpey, Inc., Woodside, N. Y 313,543
13. E. W. Foley, Inc., Brooklyn, N. Y 313,967

Item	Quan.	Unit Prices (1)	(2)	(3)
Clearing and grubbing	Lump Sum	$28,000.00	$20,750.00	$25,250.00
Clear. and grub., if ordered	10 ac.	140.00	150.00	250.00
Clear approach zones and obstruction areas	175 ac.	130.00	75.00	100.00
Earth excavation	200,000 c. y.	.30	.41	.41
6-in. vitr. tile pipe, open joint	12,360 l. f.	.60	.50	.65
12-in. vitr. tile pipe, open joint	1,500 l. f.	1.08	.75	1.05
15-in. concrete pipe, open joint	2,600 l. f.	1.40	.85	1.25
18-in. concrete pipe, open joint	2,000 l. f.	1.90	1.10	1.50
21-in. concrete pipe, open joint	1,300 l. f.	2.76	1.75	1.95
24-in. concrete pipe, open joint	1,000 l. f.	3.24	2.25	2.40
6-in. vitr. tile pipe, sealed joints	1,400 l. f.	.65	.65	.80
12-in. vitr. tile pipe, sealed joints	260 l. f.	1.20	1.10	1.35
15-in. vitr. tile pipe, sealed joints	100 l. f.	1.50	1.65	1.92
18-in. vitr. tile pipe, sealed joints	800 l. f.	2.10	2.15	2.55
21-in. vitr. tile pipe, sealed joints	700 l. f.	2.85	2.90	3.35
24-in. vitr. tile pipe, sealed joints	400 l. f.	3.30	3.60	4.25
27-in. rein. conc. pipe, sealed joints	50 l. f.	4.92	3.35	3.25
30-in. rein. conc. pipe, sealed joints	900 l. f.	5.58	3.85	3.90
36-in. rein. conc. pipe, sealed joints	50 l. f.	7.50	5.15	5.75
42-in. rein. conc. pipe, sealed joints	650 l. f.	9.00	6.00	6.45
48-in. rein. conc. pipe, sealed joints	600 l. f.	10.26	7.05	8.65
54-in. rein. conc. pipe	450 l. f.	16.62	9.75	10.35
Excavation for drainage	12,000 c. y.	.70	1.50	1.32
Compacting earth backfill	8,000 c. y.	.50	.75	.35
Porous backfill	3,200 c. y.	4.00	1.50	5.00
Concrete for headwalls	60 c. y.	40.00	30.00	35.00
Manholes, Type A, solid covers	4 ea.	225.00	150.00	160.00
Manholes, Type A, grate covers	8 ea.	225.00	150.00	160.00
Manholes, Type B, grate covers	60 ea.	145.00	150.00	95.00
Catchbasins	70 ea.	75.00	100.00	90.00
Stone riprap	20 c. y.	18.00	20.00	20.00
Placing sod for berm protection	27,000 s. f.	.07	.25	.12
Underground ducts	4,500 l. f.	.50	1.50	1.00

Schedule II—Airport Paving

LIST OF BIDDERS:

1. The Grandview Co., Mt. Vernon, N. Y. (contract) $353,000
2. Woodcrest Constr. Co., Inc., and Rosoff Bros., Inc., New York, N. Y 353,000
3. DuBois Constr. Co., New York, N. Y 365,700
4. George & Lynch, Wilmington, Del 368,000
5. Peter Mitchell, Inc., and Paul Bacco & Sons, Inc., Greenwich, Conn. 374,500
6. Edward Acker Co. and Tuckahoe Constr. Co., Tuckahoe, N. Y. 390,400
7. Frank Stento & Sons, Binghamton, N. Y 405,750
8. Alcan Construction Co., Mt. Vernon, N. Y 416,500
9. Union Paving Co., Philadelphia, Pa 423,750
10. E. W. Foley, Inc., Brooklyn, N. Y 428,000
11. John Arborio, Inc., Poughkeepsie, N. Y 431,000
12. Triangle Contracting Co., Newark, N. J 443,000
13. James A. Monroe & Sons, North Attleboro, Mass 458,000
14. Robert W. Cleveland & Co., East Orange, N. J 459,500
15. Central Pennsylvania Quarry, Stripping & Construction Co., Hazleton, Pa. 473,000

Item	Quan.	Unit Prices (1)	(2)	(3
1. Earth excavation	500 c. y.	$1.00	$1.00	$0.90
2. 7-in. cement conc. pavement	150,000 s. y.	2.35	2.35	2.435

GRADE SEPARATION, NEW JERSEY

OWNER: New Jersey State Highway Dept., Trenton.

PROJECT: Grade separation at Port Street, Newark, Essex County, New Jersey. Involves necessary site clearing, roadway excavation (earth), removing reinforced concrete and granite block pavement, roadway paving, curbing, drainage structures, reinforced concrete structures, and all other work necessary for completion of project.

CONDITIONS: Contractor to furnish all materials. Rail and highway transportation facilities available. Minimum wage rates specified are: skilled labor, $1.20 per hour; semi-skilled, 65c.; and common, 50c.

BIDS: Five bids were received September 13, 1943, ranging from the low of $346,529 to $393,190.

LIST OF BIDDERS:

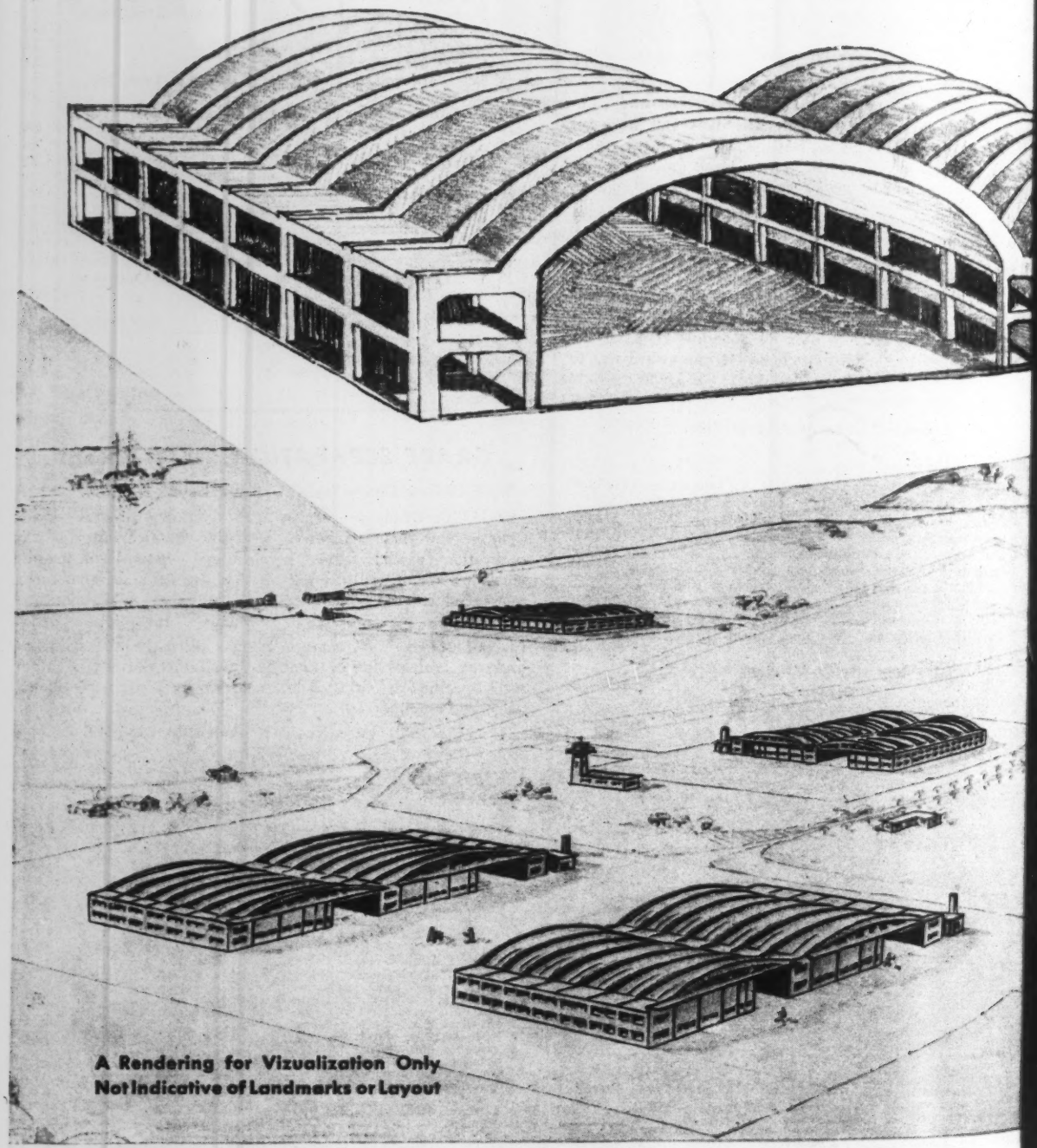
1. Union Building & Constr. Corp., Passaic, N. J. (low bidder) $346,529
2. George M. Brewster & Son, Inc., Bogota, N. J 363,240
3. Franklin Contracting Co., Newark, N. J 366,922
4. H. L. Harrison & Son, Newark, N. J 371,650
5. S. J. Groves & Sons Co., Ridgefield, N. J 393,190

Item	Quan.	Unit Prices (1)	(2)
1. Clearing site	Lump Sum	$1,000.00	$750.00
2. Roadway excavation, earth	10,992 c. y.	.60	1.00
3. Pavement excav., rein. conc	2,329 s. y.	.85	.45
4. Pavement excav., granite block	5,040 s. y.	1.25	.60
5. Removal of swamp sod	4,329 c. y.	1.50	1.00
6. Borrow excavation	156,941 c. y.	.89	1.14
7. Ditch excavation	144 c. y.	2.50	1.25
8. Earth excavation, sub-surf. struct	100 c. y.	3.00	1.00
9. Topsoiling, 4-in.	33,447 s. y.	.30	.32
10. Topsoiling, 6-in.	1,589 s. y.	.34	.33
11. Macadam base course, 5-in. thick	25,237 s. y.	.75	.75
12. Waterbound macadam intermediate course, 2½-in. thick	25,237 s. y.	.50	.35
13. Pavement, Type FA-BC-2, 3-in. thick	25,237 s. y.	1.45	1.00
14. 18-in. rein. conc. culv. pipe	2,593 l. f.	2.45	2.50
15. 24-in. rein. conc. culv. pipe	630 l. f.	3.25	3.50

(Contract Unit Prices continued on p. 132)

Economically Completed!

A Project in CONCRETE...

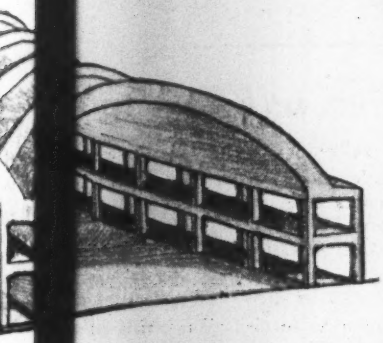


A Rendering for Vizualization Only
Not Indicative of Landmarks or Layout

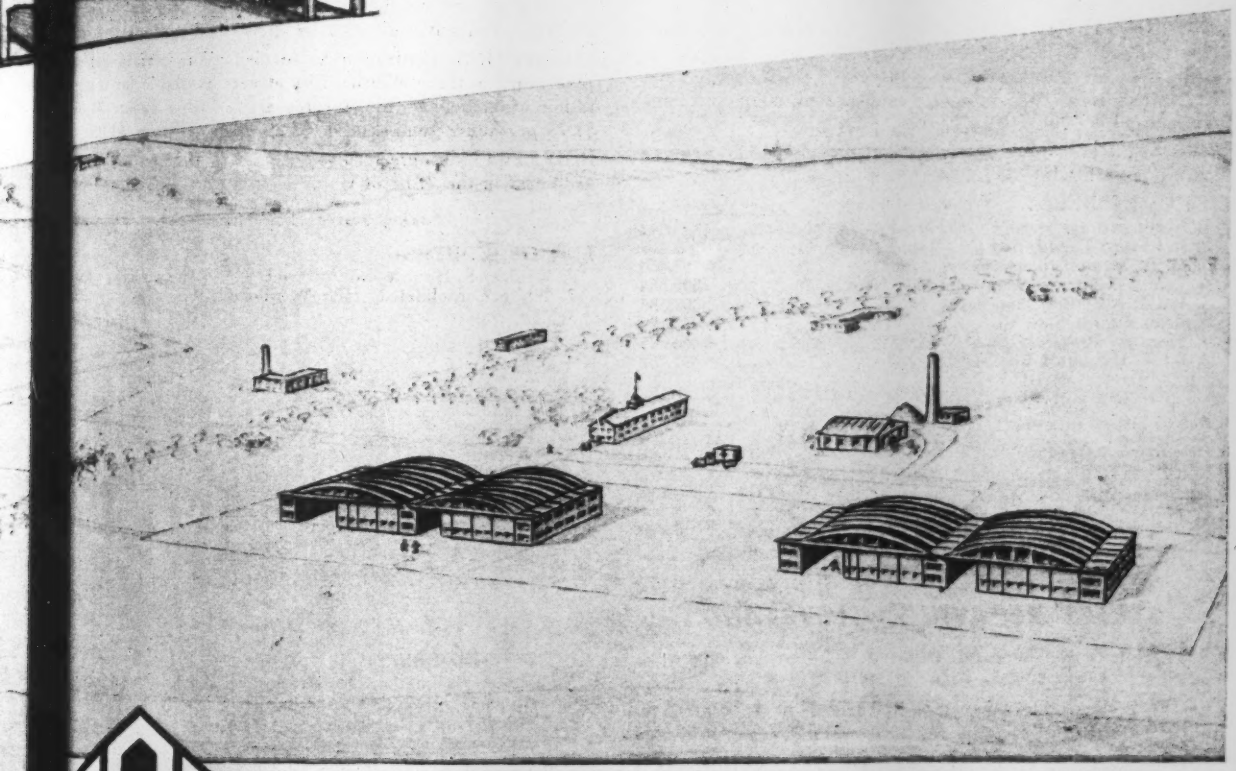
. . Six Twin-span Hangars

that

1. Saved Critical Materials!
2. Eliminated Fire Hazards!
3. Reduced Maintenance!
4. Insured Permanency!



DESIGNS BY
ROBERTS & SCHAEFER COMPANY · ENGINEERS · CHICAGO, ILL.



CORBETTA CONSTRUCTION COMPANY, INC.

FOUNDED UPON "GETTING THINGS DONE"

EXECUTIVE OFFICE: 220 EAST 42nd STREET, NEW YORK 17, N. Y.

ORA • NEBRASKA • WEST VIRGINIA • PENNSYLVANIA • OHIO • MARYLAND • DELAWARE • NEW JERSEY

(*Contract Unit Prices continued from p. 129*)

16. 30-in. rein. conc. culv. pipe	19 l. f.	5.00	5.00
17. Manholes, concrete tops	3 ea.	125.00	150.00
18. Special manholes, wood tops	3 ea.	120.00	150.00
19. Inlets, Type B and D (wood tops)	19 ea.	140.00	125.00
20. Inlets, Type A (wood tops)	8 ea.	140.00	125.00
21. Inlet, Type B, with exist. casting	1 ea.	100.00	100.00
22. Extra depth manholes, below 8-ft.	8 l. f.	12.00	20.00
23. Extra depth inlets, below 8-ft.	8 l. f.	12.00	20.00
24. Reset inlet heads	4 ea.	10.00	20.00
25. Reset manhole heads	5 ea.	10.00	20.00
26. Grouted granite block gutter	18 s. y.	3.50	5.00
27. 7x20-in. white conc. vert. curb	13,882 l. f.	1.50	1.31
28. 15x8-in. white conc. sloping curb	502 l. f.	1.50	1.42
29. 24-in. white conc. sloping curb	1,560 l. f.	1.75	1.61
30. Reset granite curb	1,608 l. f.	1.25	1.13
31. 4-in. concrete sidewalk	112 s. y.	2.50	2.42
32. 6-in. concrete sidewalk	44 s. y.	3.10	2.96
33. 6-in. cinder sidewalk	344 s. y.	.90	.80
34. Headwalls	12 c. y.	40.00	32.00
35. Wood guard fence	1,281 l. f.	1.75	1.75
36. Reset wire rope fence	2,650 l. f.	.70	.50
37. Project marker posts	2 ea.	25.00	20.00
38. 4-in. asbestos-cement conduit (water)	200 l. f.	1.50	1.25
39. 2½-in. asbestos-cement conduit (elec.)	367 l. f.	1.25	1.00
40. Foundation excavation	536 c. y.	2.50	15.00
41. Treated timber piles	8,600 l. f.	1.50	1.45
42. Class B conc. in structures	163 c. y.	58.50	45.00
43. Class C conc. in structures	1,029 c. y.	25.00	20.00
44. Class D conc. in structures	396 c. y.	13.00	12.50
45. Concrete balustrade	137 l. f.	9.00	7.75
46. Reinforcing steel in structures	29,960 lb.	.08	.08
47. Structural steel	740 lb.	.50	.10
48. Waterproofing	520 s. f.	.50	.50
49. 1¼-in. galv. wrt. iron conduit	260 l. f.	1.25	1.00

HIGHWAY, NORTH DAKOTA

OWNER: North Dakota State Highway Dept., Bismarck, N. D.; J. S. Lamb, commissioner.

PROJECT: Stabilized base and bituminous surfacing 21.971 miles of highway in Benson and Ramsey Counties, N. D., on U. S. Highway 2, Churches Ferry to Devils Lake.

CONDITIONS: Contractor to furnish all materials and complete work in 160 sixteen-hour working days. Rail and highway transportation facilities available to site of work. Wage rates are: skilled labor, 80c. per hour; semi-skilled, 60c.; and common labor, 45c.

BIDS: Eight bids were received September 3, 1943, ranging from the contract low of $333,842 to $492,782.

LIST OF BIDDERS:

1. Northern Improvement Co., Fargo, N. D. (contract) ... $333,842
2. Northwest Engineering Co., Rapid City, S. D ... 349,369
3. M. B. Manson, Bismarck, N. D ... 368,460
4. Inland Construction Co., Omaha, Nebr ... 396,364
5. W. H. Noel Co., Jamestown, N. D ... 397,583
6. Peter Kiewit Sons Co., Omaha, Nebr ... 423,122
7. Megarry Brothers, St. Cloud, Minn ... 464,678
8. G. W. Haggart & Co., Fargo, N. D. ... 492,782

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Water for subgrade preparation	338 M gal.	$3.00	$2.00	$1.00
2. Stabilized base	172,711 ton	1.05	1.14	1.20
3. Prime bitumen (MC-1 for prime)	194,530 gal.	.10	.115	.11
4. Combined aggregate	35,369 ton	1.70	1.50	2.00
5. Mix bitumen (MC-3 or MC-5)	353,690 gal.	.10	.112	.10
6. Seal bitumen (MC-5)	166,478 gal.	.10	.115	.11
7. Seal aggregate (Grade 2)	3,406 ton	5.00	4.00	4.00
8. Blotter sand	1,427 ton	2.00	2.80	1.00

STREET REPAVING, CLEVELAND

OWNER: City of Cleveland, Ohio; J. C. Wenrick, city engineer.

PROJECT: Repaving over water line trench in St. Clair Ave. from London Rd. to Melville Rd. in Cleveland, Ohio. Requires 2,875 sq. yd. of concrete repaving and 7,900 sq.yd. of brick repaving, and necessary curbing, gutters, and setting catch-basin castings, vault frames and valve boxes to grade.

CONDITIONS: Contractor to furnish all materials. No stipulated contract time is specified. Highway transportation facilities available. Wage rates are: skilled labor, $1.50 to $1.75 per hour; semi-skilled, $1.25; and common, $1.00.

BIDS: Three bids were received August 19, 1943, ranging from the contract low of $79,780 to $83,968.

LIST OF BIDDERS:

1. Lombardo Brothers Constr. Co., Cleveland, Ohio (contract) ... $79,7
2. Cuyahoga Asphalt and Paving Co., Cleveland, Ohio ... 81,0
3. Galier Brothers, Cleveland, Ohio ... 83,9

Item	Quan.	Unit Prices (1)	(2)	
1. Excavation and fill	3,900 c. y.	$2.00	$2.40	$
2. 15½x8x10-in. concrete foundation	7,300 s. y.	4.00	4.20	
3. 8-in. concrete foundation	125 s. y.	4.00	3.50	
4. 7-in. concrete foundation	2,750 s. y.	3.00	3.20	
5. 4-in. brick pavement, grout filled (incl. gran. slag cushion)	7,900 s. y.	3.25	2.95	
6. 2-in. asphaltic concrete (T 7-B)	2,300 s. y.	1.00	1.45	
7. Reset existing sandstone curb	100 l. f.	1.00	.90	
8. Reset existing granite curb	750 l. f.	1.00	1.20	
9. Furn. and set 5x20-in. sandstone curb	50 l. f.	2.00	2.00	
10. Furn. and set 5x20-in. granite curb	100 l. f.	3.00	3.00	
11. Clean and relay stone block	85 s. y.	1.00	5.00	
12. New granite block pavement	100 s. y.	5.00	7.50	
13. Set catchbasin castings	25 ea.	10.00	15.00	
14. Set vault frame to grade	3 ea.	30.00	20.00	
15. Set valve boxes to grade	10 ea.	30.00	12.00	
16. Additional concrete, Class 2	8 c. y.	20.00	15.00	
17. Additional concrete, Class 6	10 c. y.	15.00	14.00	
18. Puddling	10,000 s. y.	.10	.03	
19. Pressure grouting	7,900 s. y.	.30	.20	
20. Additional asphaltic concrete (T 7-B)	10 ton	10.00	14.50	

STREET PAVING, MILWAUKEE, WIS.

OWNER: City of Milwaukee, Wis.; J. P. Schwada, city en

PROJECT: Sheet asphalt paving (concrete base) North Ric ards St. from East Vienna Ave. to East Capitol Drive, a North Sixteenth St. from West Wisconsin Ave. to West K bourn Ave. in Milwaukee, Wis. Includes necessary cut a fill, curbing, gutters, drives and walks, and removal of some existing pavement, walks, curbs, drives and gutters.

CONDITIONS: Contractor to furnish all materials and co plete work in three months. City streets available for transpo tation of materials. Wage rates are: skilled labor, $1.40 $1.75 per hour; semi-skilled, $1.25; and common, $1.05.

BIDS: Two bids were received August 9, 1943 on each proje as shown in the "List of Bidders" below.

Paving North Richards Street

LIST OF BIDDERS:

1. William F. Hunt & Co., Milwaukee, Wis. (contract) $33.0
2. White Consolidated, Inc., Milwaukee, Wis ... 33.3

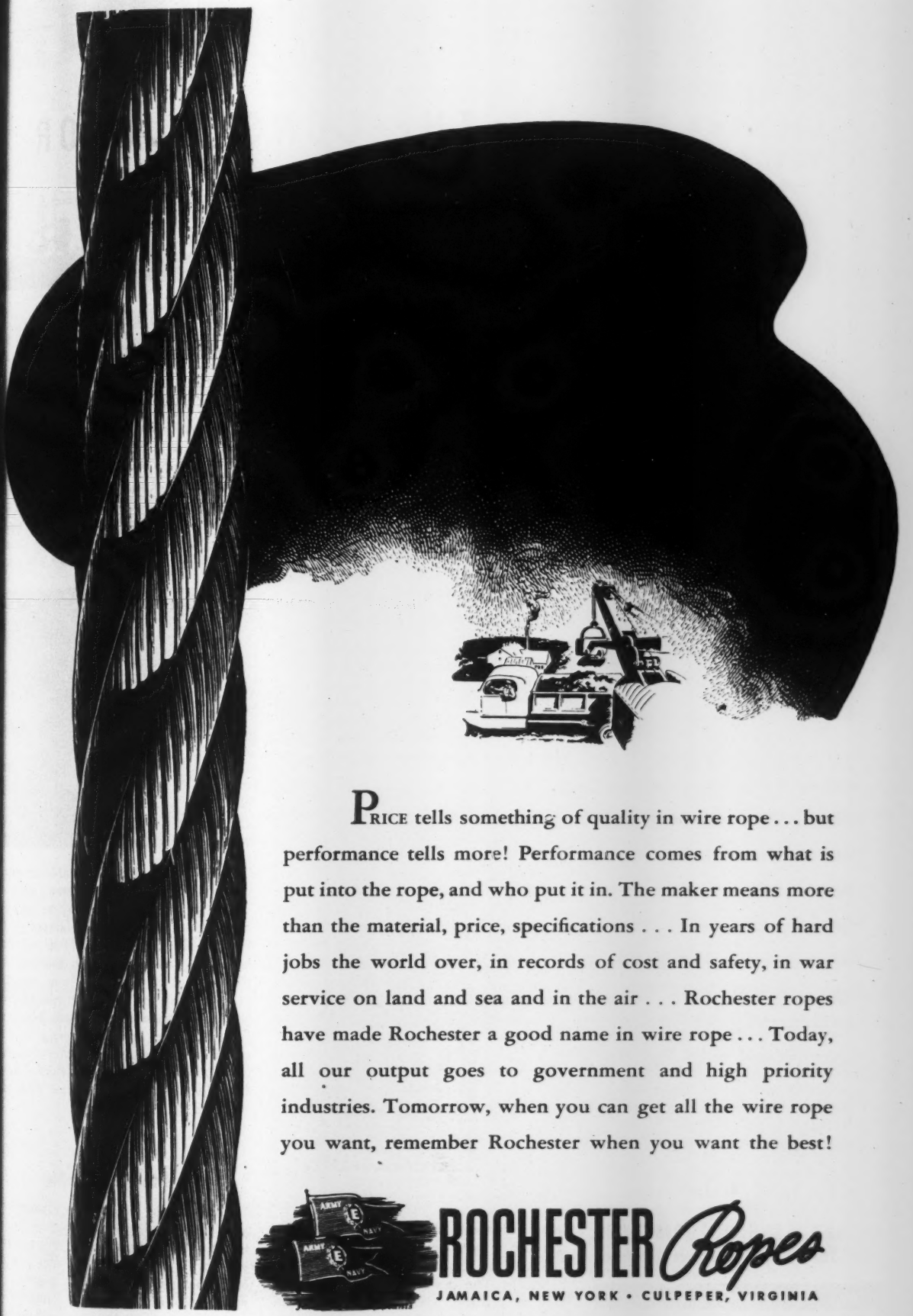
Item	Quan.	Unit Prices (1)	(2)	
1. Cut	421 c. y.	$0.70	$0	
2. Fill	237 c. y.	.70		
3. 3-in. asphalt wearing surface	6,563.53 s. y.	1.58	1	
4. 8-in. concrete base	6,191.93 s. y.	1.79	1	
5. 8-in. concrete pavement	40.45 c. y.	1.90	2	
6. 8-in. walk	13,951 s. f.	.195		
7. Curb and gutter	2,454.88 l. f.	.97		
8. Drives	2,687 s. f.	.29		
9. Walk and drive removed	19,089 s. f.	.06		
10. Pavement removed	5,561.55 s. y.	.65		
11. Surface removed	304.90 s. y.	.25		
12. Curb or curb-gutter removed	1,225 l. f.	.08		
13. Steps removed	20 l. f.	.07		
14. 3-in. concrete walks	606 s. f.	.15		
15. H. E. S. concrete base	72 s. y.	1.95	2	
16. Safety islands	37 s. f.	.45		

Paving North Sixteenth Street

LIST OF BIDDERS:

1. White Consolidated, Inc., Milwaukee, Wis. (contract) $25,8
2. William F. Hunt & Co., Milwaukee, Wis ... 26,1

Item	Quan.	Unit Prices (1)	(2)	
1. Cut	425 c. y.	$0.60	$	
2. Fill	30 c. y.	.60		
3. 3-in. std. sheet asphalt surface	5,074 s. y.	1.57	1	
4. 8-in. concrete base	4,408 s. y.	1.80	1	
5. Curb-gutter	2,009 l. f.	.90		
6. 5-in. walks	14,445 s. f.	.22		
7. 8-in. drives	1,456 s. f.	.30		
8. 3-in. walks	837 s. f.	.16		
9. Walk and drive removed	19,860 s. f.	.065		
10. Pavement removed	3,597 s. y.	.70		
11. Curb or curb-gutter removed	2,199 l. f.	.10		
12. Surface removed	520 s. y.	.25		
13. Special gutter	23 l. f.	.70	1	
14. Remove retaining wall	3 l. f.	.80	1	
15. Extra binder	20 ton	9.50	9	



PRICE tells something of quality in wire rope . . . but performance tells more! Performance comes from what is put into the rope, and who put it in. The maker means more than the material, price, specifications . . . In years of hard jobs the world over, in records of cost and safety, in war service on land and sea and in the air . . . Rochester ropes have made Rochester a good name in wire rope . . . Today, all our output goes to government and high priority industries. Tomorrow, when you can get all the wire rope you want, remember Rochester when you want the best!

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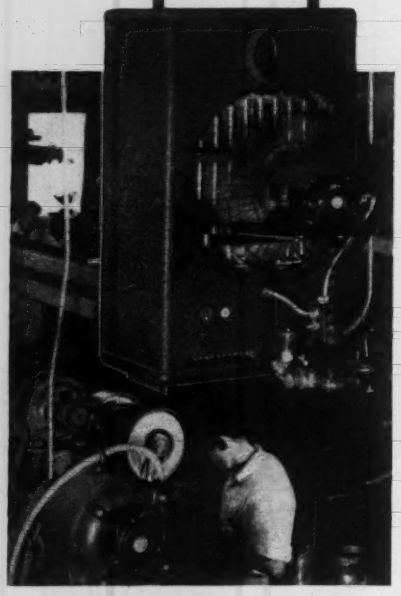
REZNOR UNIT HEATERS CRACK DOWN ON B. T. U. LOSSES



● Used as a sole source of heat, Reznor Gas Fired Suspended Unit Heaters eliminate transmission loss of heat from a central heating plant. As auxiliary equipment, they permit the main plant to remain out of service during mild periods, compensate for sudden demands during changeable weather, and avoid wasteful forcing in cold spells. Due to specially designed heat exchanger tubes, Reznor Units move more warm air over wider areas. Write today.

REZNOR MANUFACTURING CO.
105 James St., Mercer, Penna.

"GAS HEATERS EXCLUSIVELY SINCE 1888"

NEW AIDS TO THE CONSTRUCTOR

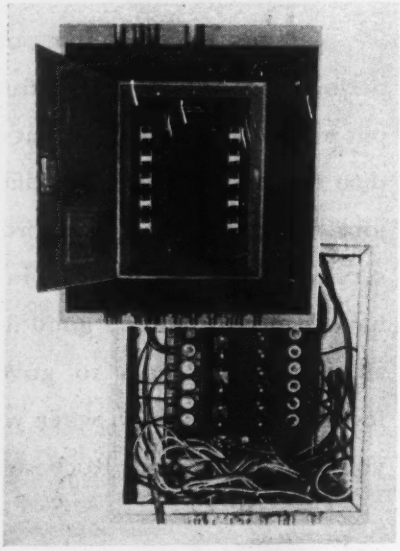
Large Generated Gear

Believed to be the highest capacity right-angle reduction drive gear ever produced by a generating process is the new 97.5-in. O. D. Cone-Drive gear. The gear and pinion were produced on standard Cone-Drive generating machines, and backlash was held to a maximum of 0.0003 to 0.0005 in. Reduction ratio of the gearset is 192 to 1; pinion diameter is 7 in. — *Cone-Drive Division, Michigan Tool Co., Detroit, Mich.*

• • •

Multi-Breaker Convertible Panel Plan

Overloading of old-style panelboards to meet rush war demands is eliminated by conversion of fusible panelboards to circuit breakers with increased circuits and capacities, according to the manufacturer. It is said that this convertible panel plan has increased capacity 400 percent in some instances, but that the average increase is between 50 and 100 percent.

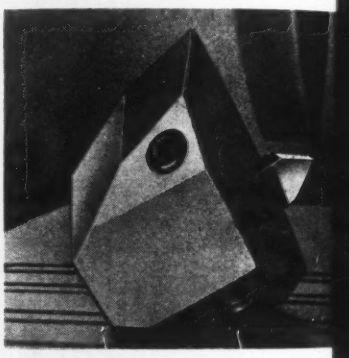


Under the "Square D" plan, conversion is simple. The installed box and conduit may be utilized, saving materials, labor cost and change-over time.—*Square D Company, 6060 Rivard St., Detroit 11, Mich.*

• • •

Grinding Fixture

Extreme precision is attained in grinding both 60-deg. and 29-deg. threading tool bits with a new thread-tool grinding fixture, according to the manufacturer's announcement. This time-saving fixture has no graduated scales or moving parts; the machinist merely slides the bit into the holder, tightens a setscrew and places



the fixture on the work table in proper position for the desired thread angle.

The grinding fixture may be used with a magnetic chuck, or clamped to the work table. It is available in two standard sizes, each of which takes all tool bits within a ⅛-in. to ⅝-in. range. A third model for grinding special angles on blades used in the Clark 3-blade adjustable hole cutter is being manufactured, and fixtures for other dual-angle combinations can be provided.—*Robert H. Clark Co., 3424 Sunset Blvd., Los Angeles 26, Calif.*

• • •

Plastic Coating

Some of the advantages claimed for a new plastic protective coating for ventilating equipment are that it has great salt-spray resistance, provides true colloidal suspension of color pigment, is a rust inhibitor, and insures uniform dis

ADAMS GRADERS

HELP TO PREPARE FOR THE BIG PUSH NORTHWARD

FROM AUSTRALIA

ALMOST DAILY we read of the exploits of allied forces in the recapture of Jap strongholds in the islands of the Southwest Pacific. These, of course, are but the "openers" of the big northern push towards Tokyo . . . To sustain this push it has been necessary to convert Australia into a big armed camp used as the base for tremendous forces of troops and quantities of materiel. This has called for the construction of many army camps, military roads and air fields. In this big construction program Adams graders have had an important part . . . In many other parts of the world—in Alaska and the Aleutians, in England, in Africa, Sicily and the Near East, in Central and South America — Adams equipment builds facilities for the successful prosecution of the war . . . When peace comes, turn to your Adams dealer for tried and proven equipment.

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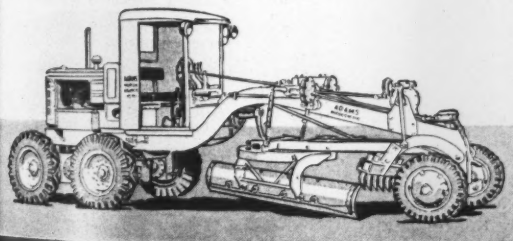

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tribution of covering and thickness of durable surfaces.

This plastic coating, known as "Plast-Anneal," is applied after fabrication, thus covering and protecting all surfaces and interstices of the ventilating units. According to the manufacturer, the basic formula of the coating can be altered to meet special atmospheric conditions.—*Allen Corp., 9751 Erwin St., Detroit, Mich.*

. . .

Rubberless Building Wire

Using neither rubber, nor equally scarce tin, a new type of building wire insulates the copper conductor with cellulose-acetate butyrate tape. It is further protected with a heavy layer of moisture-proof compacted Kraft paper. As no rubber insulation is involved, no tin coating for the conductor is necessary. This new wire, called "Hazapak," is approved by the Underwriters Laboratories, Inc.

Two types of this Hazapak building wire are available: Type EG (emergency

Bare copper conductor.
Kodapak (cellulose-acetate butyrate) tape insulation.
Moisture-proof compacted kraft paper cushion.
Flame and moisture-resistant covering.

grounded) for use as the neutral grounded conductor in A. C. circuits and as the "white" conductor in cable assemblies; and Type EI (emergency insulated) for a single conductor in open wiring, and as the "hot" wire in non-metallic sheathed cables that is run exposed in dry locations. This wire may be obtained in all building wire sizes for 600 volt ratings, and in all standard colors, with full surface identification markings and footage measurements.—*Hazard Insulated Wire Works Division of The Okonite Co., Wilkes-Barre, Pa.*

. . .

High-Speed Printer

Prints of engineering plans are produced a hundred times more quickly with the aid of a new mercury-vapor quartz lamp, the manufacturer claims, than with ordinary light. The prints are direct positive black-and-white copies. The new light tube is equivalent to six to eight powerful carbon arc lamps.—*Charles Bruning Co., Inc., 102 Reade St., New York, N. Y.*

. . .

Industrial Thermometer

Though the plastic used in a recently marketed industrial thermometer reduces its weight and substitutes adequately for metal, it is not affected by the temperatures found under actual service condi-

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Blue Brute Compressors, too . . . portable and semi-portable, gasoline, Diesel, and electric-driven . . . will save you time and good hard cash. Their "throats", smoothed by time-tested Feather Valves* . . . *deliver more air* for less money under toughest service conditions.

Ask for a Blue Brute air-power team, best for your money. Get a demonstration now, on your present job!

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BLUE BRUTES

Blue Brutes today support the fighting front in Europe, just as they helped the British 8th Army turn back Rommel from the Nile. In the U. S., they provide air power for thousands of industrial operations, as well as construction projects, in Navy Yards, Army Camps, Air Bases and Ordnance Plants throughout the country. Your nearest distributor is listed on page 136.

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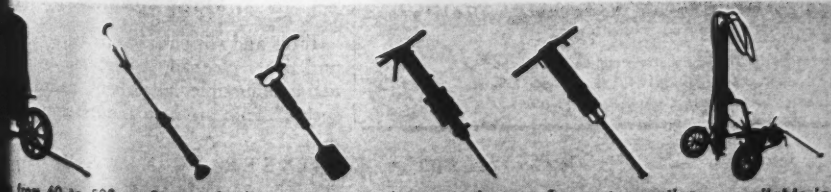

from 60 to 500 cu. ft. capacity in mount- ll jobs. Rock Drills and Air Tools that have always set the pace for easy operation — available in a wide range of weights and sizes.

WORTHINGTON

Worthington Pump and Machinery Corporation, Harrison, N. J. Holyoke Compressor and Air Tool Department, Holyoke, Massachusetts

When gears are designed correctly, precision cut and properly mated, their engagement and running is smooth and noiseless. This means they will deliver their maximum wear-life with a minimum demand for service or parts replacement. The life of your Fuller Transmission, if given ordinary care and proper lubrication, should equal or excel the life of your truck. The Fuller Handbook tells you how to give your transmission proper care. If you have not received your copy, write our Service Department.

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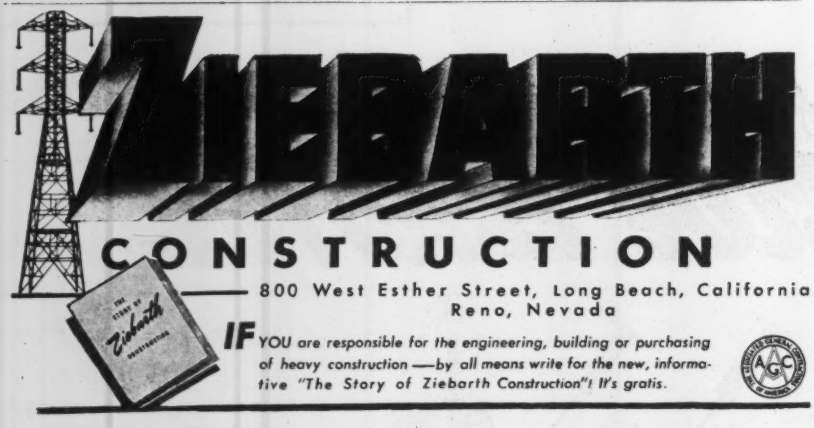
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800 West Esther Street, Long Beach, California
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IF YOU are responsible for the engineering, building or purchasing of heavy construction —by all means write for the new, informative "The Story of Ziebarth Construction"! It's gratis.

tions, the manufacturer claims. The thermometer uses yellow-back lens-front tubing, the yellow background offering the best color contrast with the mercury. Brass thermometer parts are replaced by malleable iron, protected against corrosion by a durable black finish.

In case of breakage, either the thermometer tube or the entire front can be replaced at nominal cost.—*C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y.*

• • •

Hardened-Shank Reamers

Great strength and reduced shank wear are said to characterize new carbide-tipped reamers with hardened shanks. The new standard line of Tungsten Carbide reamers comprises both straight and tapered-shank types, with sizes ranging from ¼ in to 1½ in. in both styles. Up to 1 inch, the reamers come in steps of 1/32-in.; above 1 inch, 1/16 in. Reamers up to ½ in. are provided with four flutes; ½ to 13/16-in. reamers have six flutes; larger sizes, eight flutes.

Reamer tips are diamond-ground, ready to use. The O. D. is held to tolerances of plus 0 and minus 0.0003 in.—*Tungsten Carbide Tool Co., 2661 Joy Road, Detroit 6, Mich.*

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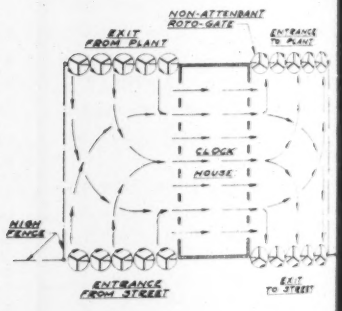
Turnstile Traffic Control

Developed recently for shipyard use, an arrangement of one-way turnstiles has automatically enforced orderly one-way traffic. Some of the advantages claimed



for this system are: Traffic through time clock section is always in the same direction; no attendants are required, confusion is eliminated; time-card stamping is speeded up.—*Perey Turnstile Co., 101 Park Ave., New York 17, N. Y.*

• • •

Grease Absorbent—Floor Cleaner

Fires and slipping hazards are reduced and floors cleaned, it is stated, by a new non-combustible absorbent called "Absorbo." This product, though granular in

rm. is said to be non-abrasive; it is also orless, non-poisonous and non-injurious skin, clothing or flooring.

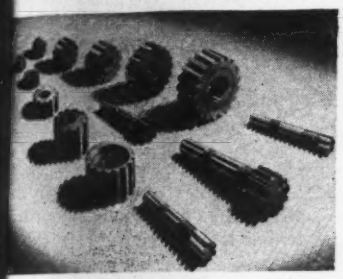
This absorbent, readily spread by hand any type of floor surface, absorbs up 45 to 50 percent of oil or grease by ight. It is available in 50-lb. bags. mples, descriptive literature, and copies the Underwriters' Laboratories report y be obtained. — *Fidelity Chemical oducts Corp., 430 Riverside Ave., ewark, N. J.*

. . .

Standard Thread Cutters

To speed delivery and simplify order- g, a new line of standardized thread illing cutters has been developed. As anks in standard sizes are carried in ock by the manufacturer, ordering is ne by merely stating the blank number d thread specifications desired.

Shell and shank type cutters are car- ed. The diameter range of the 40 dif- rent shell-type blanks in stock is from



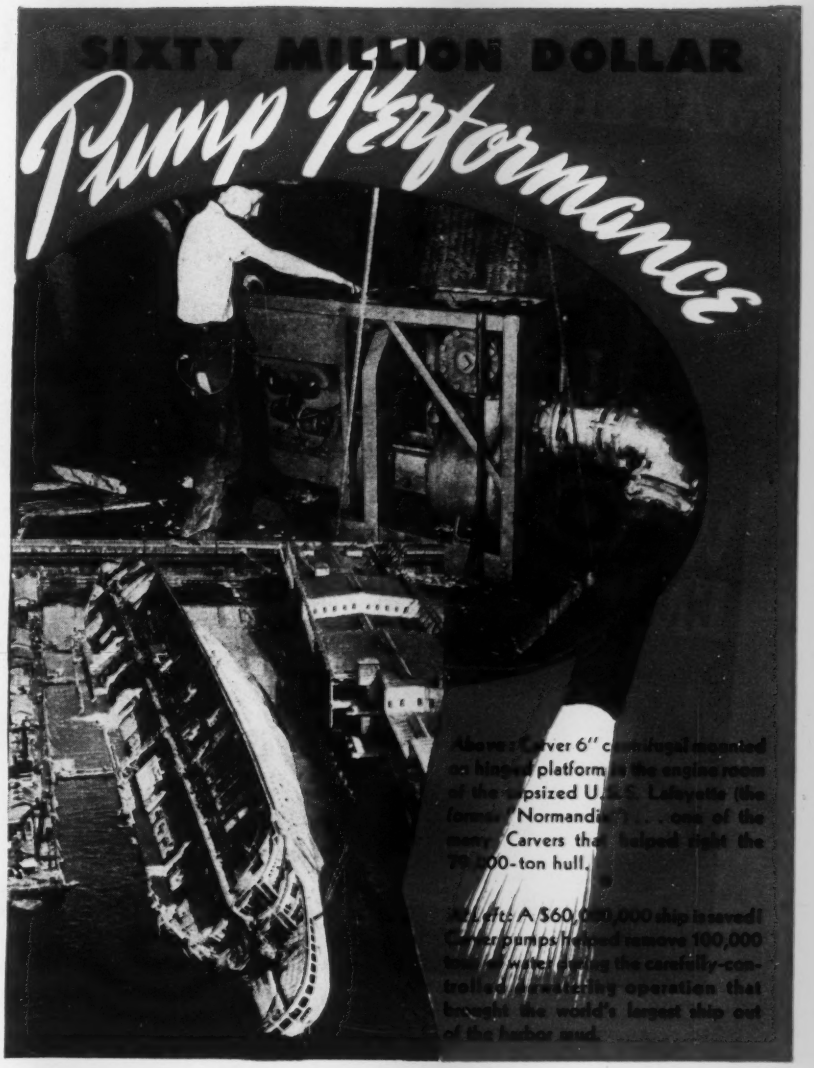
½ to 3½ in.; the number of flutes varies ith the size of the blanks. Face widths ary from ½ in. to 2 in., and hole sizes rrespond to standard thread-milling achine arbors. Twelve shank-type lanks are carried in stock, ¾ in. to 1½ . in diameter. Face widths vary from 1 1½ in.; shanks are from 3½ to 5 in. ng. Both types of blanks have right- nd spiral flutes and a 5-deg. rake ngle.—*Detroit Tap & Tool Co., 8432 utler, Detroit 11, Mich.*

. . .

Flexible Tubing Fastener

Claimed to be extremely simple and idely useful, the new Packless flexible stener combines the functions of a pporting strap and a vibration absorber r stationary or movable tubing. The stener consists of a sensitive, cone- piraled spring, terminating in a clip hich snaps onto the tube. Affixed to a pporting surface by a standard or ood screw fitted through the cone, the stener flexes in all directions and thus an be installed in either lateral or verti- al position.

When supporting flexible hose, the stener prevents whip and counteracts frequency;" used with copper tubing, its



CARVER CERTIFIED CENTRIFUGALS will show you something new in profitable pump performance on *your* job, too. Carver's are the sturdy, fast-priming units that handle mud, sand or grit without a murmur; the pumps with the Lifetime Seal that keeps water *in* and air *out* for good!

If there's a pumping operation involved in *your* job, you'll be hours and dollars ahead to see your nearby Carver distributor *now*. Or write us today for the big new Carver Catalog.

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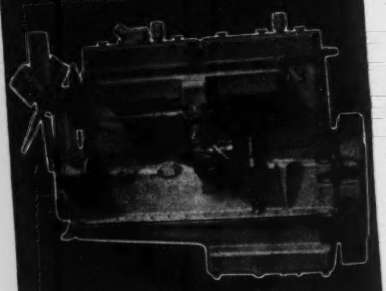


Iron ore is hauled right from the mine by Walter Tractor Trucks, with 35-ton side dump ore trailers, powered with 300-hp. Model 6-WAK Waukesha Engines, 6½" bore x 6¼" stroke, 1197 cu. in. displacement.

...give Walter Ore Tractors extra power

Snyder Mining Company, Chisholm, Minn., has an off-the-highway hauling job that's tough—hauling iron ore right out of the mine.

Walter Tractors are doing it . . . and doing it well. All four of these new ones have Waukesha Engines.

These big, butane-burning Model 6-WAK Waukesha Engines are designed and engineered to deliver greater power per cubic inch displacement. Or, as the mining company's truck drivers call it—"plenty of power and lots of zip" according to Mr. Tancig, general mechanical superintendent, who also says, "the truck drivers like to drive these large units." *Get Bulletin 1138.*

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
NEW YORK • TULSA • LOS ANGELES

MORE POWER FOR VICTORY

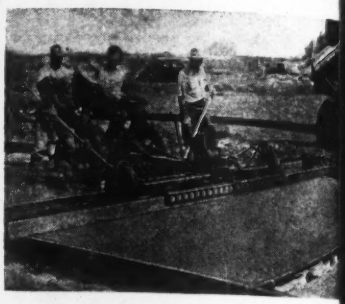
WAUKESHA ENGINES

free action in all directions prevent crystallizing of the copper.—*Packless Metal Products Corp., New Rochelle, N. Y.*

• • •

Tractor-Type Rodding Machine

Of particular interest to highway departments and contractors is a new Model T tractor-type rodding machine, which has been extensively tested on highways, airport ramps and runways and housing project foundations. Weighing only 750 lb., this rodding unit is propelled and steered with large tractor wheels, having a clutch disengage the wheels from the drive for easy maneuverability. Small wheels on each end of the rodder are set down to carry the weight of the machine



when it is moved. These also relieve the weight on an extra wide span, as they are adjusted to lift slightly to maintain the proper level.

This new rodder unit will list at approximately $1,000, although the exact price has not yet been determined. Because of restrictions under Order L-192, steel tractor wheels with cast iron lugs, and with wood tires on the smaller wheels, are used, instead of the rubber tires illustrated.—*Whiteman Manufacturing Co., 3429 Casitas Ave., Los Angeles 26, Calif.*

• • •

Inspectors' Stamps

In view of the great increase in the use of Magnaflux inspection equipment, a new line of inspectors' stamps has been announced. The stamp incorporates the letters "MF" and a numeral or letter within a specially shaped border. Circular, oval, square, or triangular borders are available, as required for particular jobs. This design indicates at a glance what parts have been inspected, it is said, and permits ready identification of the operator who has passed the part through Magnaflux inspection.—*New Method Steel Stamps, Inc., 147 Jos. Campau St., Detroit 7, Mich.*

• • •

Hard Hat

Three-way protection to its wearer is

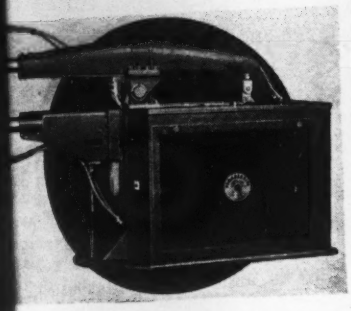
laimed for a new hard hat, named Hedgard," in spite of its minimum eight. The top of the crown is reinforced r direct blows; the side of the crown is ilt to stand glancing blows; and the im, flexible and strong, will not crack hen dropped. The shatterproof hat, eighing slightly more than 13 oz., is id to stand better than 8 pounds, opped 10 feet — twice the standard op test.

The hat has a replaceable sweat band, hich may be washed or dry cleaned. he whole Hedgard may be steam-steril-ed. — *Davis Emergency Equipment Co., alleck St., Newark 4, N. J.*

. . .

Rocker-Arm Welder

Designed specifically for condenser-charge welding of aluminum sheet, a w Model B rocker arm welder is said be exceptionally rigid and rugged. ecause of its rigidity, the welder re-ires very few point dressings in a y's run. It handles any combination two thicknesses of 24-ST Alclad, be-een 0.016 and 0.081 in., at overall



oduction rates of 1,000 to 2,000 spots r hour.

Features of the welder include ad-stable throat depth from 36 to 42 in., d a retractable upper arm for insertion flanged work; the retraction is accom-lished by a separate air cylinder con-olled by an auxiliary foot switch. lenoid-operated valves, air-pressure ges, air-regulating valves, air-line lu-icator and dual-shrouded operator's adle are provided as standard equip-ent.—*Progressive Welder Co., Detroit t, Mich.*

. . .

Portable Crushing Plant

Engineered for smooth, efficient oper-ion, and highly mobile, the new "Ced-apids" master tandem portable crush-g plant handles materials in a continu-s flow from shovel to truck or storage. his machine, which rides on six cast c wheels with dual pneumatic tires, nsists of matched-output jaw and roll ushers, screens and conveyors. Power ses and maintenance, it is said, are re-

WHICH WAY ARE YOU TREATING YOUR PORTABLE CABLES?

BAD!

GOOD!

OTHER DO'S AND DON'TS FOR LONGER CABLE LIFE:

AVOID GREASE—To make cables slide through conduit easily—use talc or soapstone—never grease except for lead sheathed cables.

CUTS—Inspect for cuts frequently, and repair promptly.

KINKS—Remove kinks carefully as soon as you see them . . . Back them out—don't try to yank them out.

SPLICING—Splice short lengths of cable. Put them to use, don't scrap them.

AVOID HEAT—Avoidance of exposure to sun's rays—and other excessive heat extends useful life.

ROEBLING ELECTRIC CABLES and wires are built to give long service. If you help them by providing proper care, they'll pay dividends in even longer operating life. Aid your workmen by posting the Do's and Don'ts of cable care where they can see them every day. Increase the value of your investment in portable cables by promoting the observance of a few simple maintenance rules.

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The greater the need for permanency

. . . the greater the need for ARKWRIGHT TRACING CLOTHS!

How can you make sure the important drawings you're working on at this moment will blueprint as satisfactorily three or four years from now as they do today? By using Arkwright Tracing Cloths! For, as any experienced draftsman will tell you, Arkwright Tracing Cloths won't tear or fray no matter how often they're blueprinted. Nor will they become brittle or opaque with age. Use Arkwright – it pays! Arkwright Finishing Company, Providence, R. I.

Arkwright TRACING CLOTHS

AMERICA'S STANDARD FOR OVER 20 YEARS

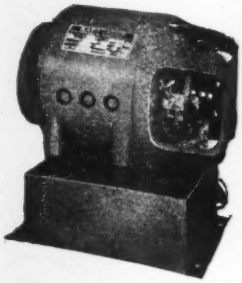
duced to a minimum. To operate t plant at full capacity only 125 to 1 hp. is required.

Designed as a gravel plant, this mast tandem can be used for quarry work b placing a primary crusher ahead of th master unit, or by the addition of speci equipment it can be transformed into complete crushing, washing and scree ing plant.—*Iowa Manufacturing Co Cedar Rapids, Iowa.*

. . .

Revolving Armature Generator

Designed for direct attachment engine bell housing, but also availab as an independent generator with stan ard shaft attachment, a new 25 kw. Kat light generator is the result of mar months of research and actual testin This generator is developed for all stan ard voltages and special voltages; it ha



a rated capacity of 25 kw. at 80 percen power factor, single phase, or 30 kw. a 80 percent power factor, three phas The unit measures 38-17/32 x 24½ 25¾ in., and weighs approximately 1,37 lb.

The generator can be furnished fo either direction rotation. All leads ar brought out externally. — *Kato Engineer ing Co., Mankato, Minn.*

. . .

Fork-Lift Truck

A wide range of capacities for handlin materials is found in the new Model LT 50 fork lift truck, it is claimed. Avail able in 5,000-lb. capacity, with either 10 or 144-in. lift, or in 4,000-lb. capacit with 144-in. lift, the new truck replace Models LT-46 and LT-53. It has a max mum travel speed of 8 miles per hour loaded lift speed is 40 feet per minute.

The lift truck has a 50-in. wheelbas outside turning radius of 92, overa width of 42 in., overall length (withou forks) of 88 in., and a center under clearance of 6 in., all of which permit th truck to function in close quarters, alon narrow aisles and over steep ramp Standard fork equipment is of 36-in length.—*Towmotor Corp., Cleveland 1 Ohio.*

SMITH Impulse Turbines

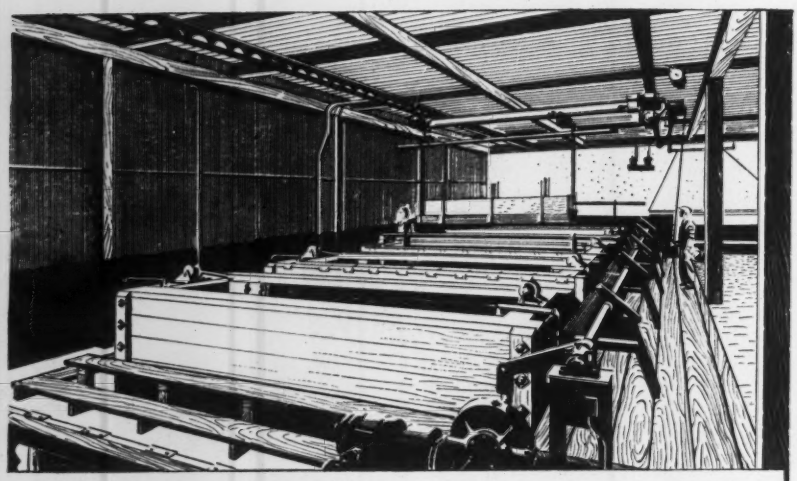
FOR HIGH HEADS, and wherever the head and water quantities available prohibit the use of reaction-type machines. Ideal for installations in remote localities because of the ease with which the completed unit may be transported. The simplicity of design, facility of operation and greater dependability remove the necessity of skilled operators and attendants. Smith's solid-cast runner design provides the additional advantages of closer spacing of buckets resulting in increased speed and consequently, a decrease in the size of the turbine unit, as well as the generator. Write for your copy of our Bulletin — "Impulse Turbines by SMITH!"

Impulse runner of *solid-cast* design, an exclusive SMITH advantage.

S. MORGAN SMITH COMPANY

YORK, PENNSYLVANIA

POWER by SMITH



Steel Makers Like WOOD For This Kind of Work

STEEL MILL pickling rooms are bad actors, where construction materials are concerned. Acid fumes and high humidities soon cause ordinary materials to become unsightly and unsafe, and make frequent replacements necessary. But Wolmanized Lumber* is able to withstand this attack.

THINK WHAT THAT MEANS to manufacturers these days, when all available man power must be devoted to production of materials for war. Less labor needs to be sidetracked for maintenance of these pickling rooms, and other Wolmanized Lumber construction.

WOLMANIZED LUMBER is ordinary wood, made highly resistant to decay and termite attack by vacuum-pressure impregnation with Wolman Salts* preservative. Service records covering millions of feet of this treated lumber, some of it in use for more than eighteen years, are proof of its durability.

LIKE OTHER WOOD construction, Wolmanized Lumber goes up easily and fast. It offers lightness with high strength, resilience and good insulating properties. It is clean, odorless, paintable. Its use adds little to first cost and saves a lot on upkeep. Plan on including Wolmanized Lumber in your postwar designs. American Lumber & Treating Company, 1649 McCormick Building, Chicago 4, Illinois.

*Registered Trade Marks

"Alloyed" FOR ENDURANCE

WOLMANIZED LUMBER

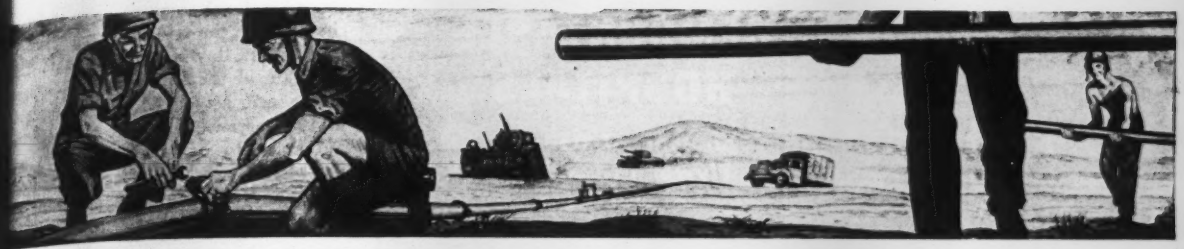
MANUFACTURERS' ACTIVITIES

KENNAMETAL, INC., with factories and main office at Latrobe, Pa., is opening a Philadelphia office and warehouse at 3701 North Broad St., for direct sales, tool engineering and service in the distribution of the company's products in the area of eastern Pennsylvania, southern New Jersey, Maryland, the District of Columbia, Virginia and certain other specific areas. William S. Jones, well known in tool steel circles, is in charge of the new office. Burton E. Middleton, hitherto Kennametal tool engineer in Rochester, N. Y., will transfer to the new Philadelphia office, and additional tool engineers will be available there.

CUTLER-HAMMER, INC., Milwaukee, Wis., manufacturers of motor control apparatus, has announced the appointment of P. S. Jones as general sales manager of the company. In his new duties Mr. Jones will have direct supervision of sales for the company through its thirty selling territories throughout the country. He first became associated with the company at Milwaukee as sales engineer in 1915, and was transferred to the Pittsburgh office in 1919, where he was later appointed branch manager. For 14 years prior to his new appointment, Mr. Jones was in charge of the New York sales territory. He is a graduate of the Ohio State University where he obtained his degree in 1915.

F. B. SCHWARTZ, manager of Minnesota Pneumatic & Electric Tool Co., Minneapolis, Minn., has been named special representative for the Northwest for the complete line of products of H. K. Porter Co., Inc., Pittsburgh, Pa., comprising industrial locomotives, chemical processing equipment, and all types of pumps.

THE UNIVERSAL ATLAS CEMENT CO., United States Steel Corp. subsidiary, has announced the following appointments: G. L. Lindsay, engineer of tests, to be assistant director of tests and research; F. P. Diener, assistant general chemist, to be chemical engineer; C. L. Davis, assistant engineer of tests, to be engineer of tests. Mr. Lindsay has been with the company for 22 years. Mr. Diener



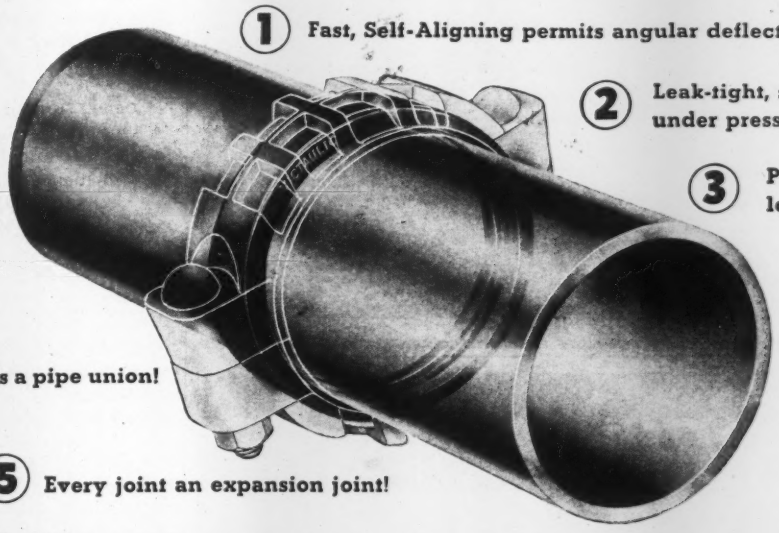
BLITZ PIPELINES

One of the potent weapons in the Allied blitz campaigns in North Africa and Sicily turned out to be Victaulic coupled portable pipelines that could be laid by unskilled or regular Army personnel at the rate of 10 to 30 miles a day so oil, gasoline, or water could keep pace with swiftly advancing troops. Specially designed pipe, grooved for Self-Aligning Victaulic Couplings, was used. Victaulic is the fastest known way of coupling pipe . . . and Victaulic gives you all these other basic advantages . . .

1 **Fast, Self-Aligning permits angular deflection!**

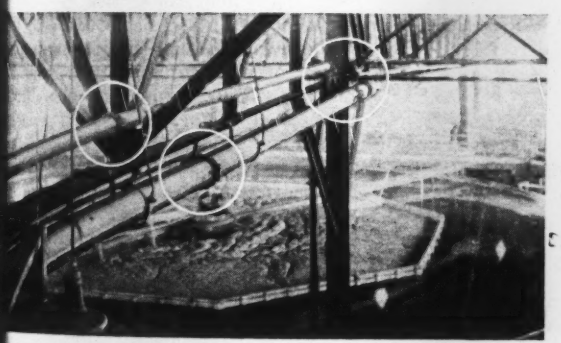
2 **Leak-tight, self-sealing under pressure or vacuum!**

3 **Positive mechanical lock of pipe lengths!**

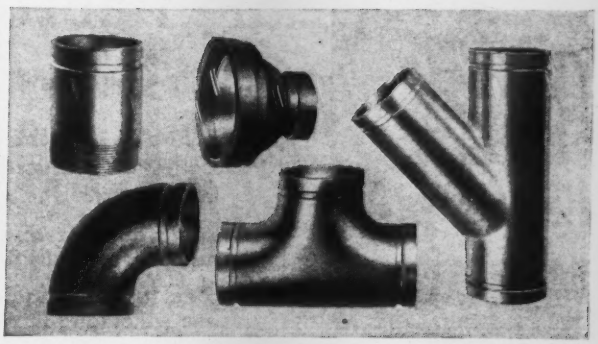


4 **Every joint is a pipe union!**

5 **Every joint an expansion joint!**



OLLAR SAVING FEATURES FOR INDUSTRIAL CONSTRUCTION! Installed faster and with less labor than any other method. A small socket wrench is the only tool needed. Victaulic joints are compact, flexible. Provide substantial savings in space and weight. Temporary lines can be salvaged 100 per cent. Maintenance is nil on permanent jobs.



VICTAULIC FULL-FLOW FITTINGS! A new line of redesigned pipe fittings to eliminate undue frictional losses! Engineered with long easy sweeps to reduce the possibility of clogging to an absolute minimum. A real contribution to greater efficiency in conducting fluids and gases in pipe systems.

INDUSTRIAL

VICTAULIC

SELF-ALIGNING PIPE COUPLINGS AND FULL-FLOW FITTINGS

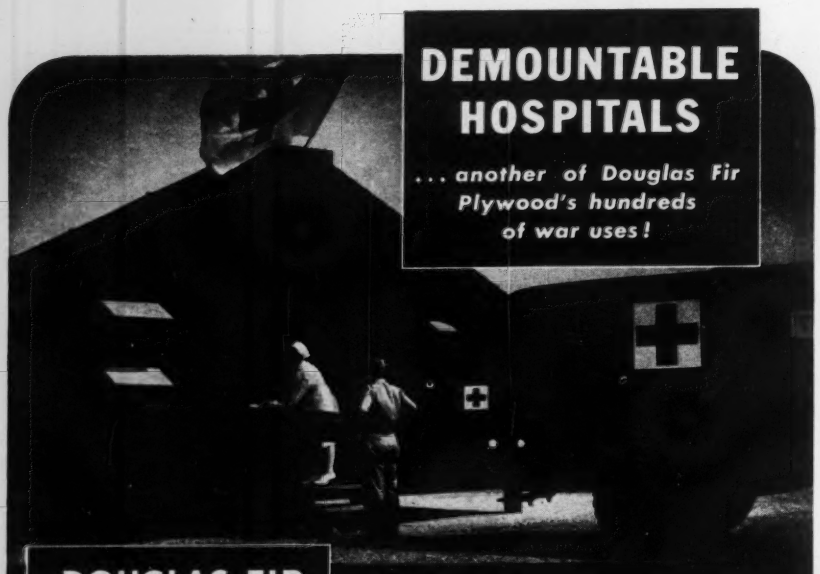
Available soon for your permanent files . . . a new easy-to-use Victaulic Catalog and Engineering Manual. Reserve your copy now!

*Name*_____

*Firm*_____

*Address*_____

Mail to nearest address: VICTAULIC COMPANY OF AMERICA, 30 Rockefeller Plaza, New York 20, N. Y.; Victaulic Inc., Los Angeles 14, California; Victaulic Co. of Canada, Ltd., Toronto. 1-F



DEMOUNTABLE HOSPITALS

... another of Douglas Fir Plywood's hundreds of war uses!

DOUGLAS FIR PLYWOOD

Real Lumber

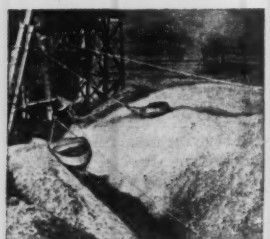
MADE LARGER, LIGHTER
SPLIT-PROOF
STRONGER

● Following close behind our soldiers on the fighting fronts are scores of demountable hospitals built of Douglas Fir Plywood by National Housing Company of Dallas, Texas. Because these sturdy, lightweight, easy-to-clean units can be quickly taken down, transported to a new location and re-erected, they are doing much to speed and facilitate the all-important work of the Medical Corps. . . . It is service like this *now* that will make Douglas Fir Plywood more useful to you *after Victory* than ever before!

NEW WAR USE FOLDER gives a photographic review of many of the ways this Miracle Wood is serving our Armed Forces. Write for your free copy. Douglas Fir Plywood Assn., Tacoma, Wash.

Big Savings

Sauerman Scraper hauls sand from hill to feed two asphalt mixing plants. One man runs the machine. Fuel cost is 40c per hour.



Two small Sauerman Scrapers handle large stockpiles of aggregates at central mixing plant on concrete dam contract.

dig, haul & dump

. . . . for a few cents per yard!

SAUERMAN Machine saves you money on your long range material handling work because:

- **Spans large area; digs and delivers anywhere within that area.**
- **Gets its load, hauls and dumps in one automatic movement.**
- **Entirely operated by one man.**
- **Power cost and maintenance expense are exceedingly low.**

Our engineers are always freely at your service to give advice and suggest cost-reducing methods based on their 35 years' experience. Write for our catalog showing hundreds of typical Sauerman jobs.

SAUERMAN BROS., Inc.
532 S. CLINTON ST. CHICAGO 7, ILLINOIS

started with the company as an analytical chemist in the Northampton plant in 1924. Mr. Davis is a civil engineering graduate of the University of Michigan. He became associated with the company in 1930 as an engineer in the inspection bureau. He has been concerned with the physical testing of cement and concrete and in the development of air-entraining portland cement.

THE RAWLPLUG CO. INC., general offices and main plant, 98 Lafayette St., New York, N. Y., has announced the retirement of Frank Arnold, for the past 10 years manager of their Cleveland office. Succeeding him is A. L. Fulkerson, formerly of the Reynolds Metals Co. Mr. Fulkerson will continue the same offices, service and warehouse. A complete line of anchoring devices will be carried in stock at the Cleveland office.

COMPLETION of a prefabricated steel "Task Force" building for demonstration to the War and Navy Departments has been announced by the Southern States Iron Roofing Co., Birmingham, Ala., producers, and the U. S. Steel Export Co., U. S. Steel Corp. subsidiary, distributors.

The building, erected at the corner of 23rd and E Sts., N. W., Washington, D. C., opposite the entrance of the Naval Hospital, is designed to provide maximum utilization of floor space with minimum shipping space requirements, together with features to supply the most satisfactory conditions for troop housing in all climates.

It is estimated that the normal number of men who would occupy such a building in the field can unpack and erect it in one day. A wrench is the only tool required. The building provides 1,000 sq.ft. of floor space, measures approximately 20x50 ft., with 7-ft. sidewalls. It is erected of 16-gage structural members on 20-in. centers, with 20-in., 24-gage steel panels. The floor, which is supported on steel beams above the ground level, is of ½ in. plywood. Controlled ventilators in the roof permit a complete change of air in the building five and a half times an hour. Insulation is provided. The buildings have already been widely used in battle areas as mobile hospital units, and their adaptability for use in the rehabilitation of occupied territories is now under study.

A "CONSUMER RELATIONS" department supplants International Harvester Co.'s advertising department. In the new set-up, advertising takes its place as one factor with other divisions effecting the consumer. Nine of these divisions are in operation. The present step is a reorganization to correlate consumer-approach activities and place concerted

SCRAM-YOU SISSIES!

Abrasion and wear know when they're licked. That's because the hard, long wearing surface deposited by Harcote guards against these saboteurs. Protecting softer steels from abrasion and wear is Harcote's way of keeping vital machines producing for Victory.

But beneath all this hard surface, Harcote is really a softie in the hands of a welding operator. Easy to work — goes on smoothly and places a weld that's tough and hard. Harcote is used on carbon steel, low alloy and high manganese surfaces. See your P&H representative for information and procedures on this and other P&H Alloy Electrodes, or write us.

Another New Star has been Added to P&H's Army-Navy "E."

P&H Alloy ELECTRODES

P&H Also Builds a Complete Line of A.C. and D.C. Arc Welders. Write for Literature.

General Offices and Factory:
4404 W. National Ave., Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION
WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

Canadian Distribution: The Canadian Fairbanks-Morse Company, Ltd.

The FIRE HYDRANT with Extra values

Extra Convenience . . . .

The Kennedy SAFETOP can be lengthened for change in street grade without excavating or shutting off the water supply, its nozzles can quickly be made to face exactly any desired direction, and all operating parts are readily accessible.

Extra Economy . . . .

Repairs to a Kennedy SAFETOP broken in a smashing collision require only a standpipe breaking ring and a stem coupling costing $6.00. These parts can be installed in less than half an hour by one man, without excavating or shutting off the water supply. Other SAFETOP economy factors are the long-wearing valve and gasket materials, and the sturdy operating mechanism.

Extra Responsiveness . . . .

Large standpipes and inlet valves, carefully shaped entrance elbow, bell-shaped nozzles, and absence of obstructions through the hydrant combine to minimize friction loss and to assure practically full main pressure at the nozzles. In addition, the simple straight-line mechanism assures easy operation.

Extra Safety . . . .

When struck by an impact which *no* hydrant could withstand, the Safety Breakable Section of the Kennedy SAFETOP parts cleanly, and no flooding can occur. Occupants of the colliding vehicle are protected from likelihood of severe personal injury, and the neighborhood is protected from damage by water or lengthy delay in returning the hydrant to service.

Send for Bulletins

The Kennedy Valve Mfg. Co., Elmira, N. Y.

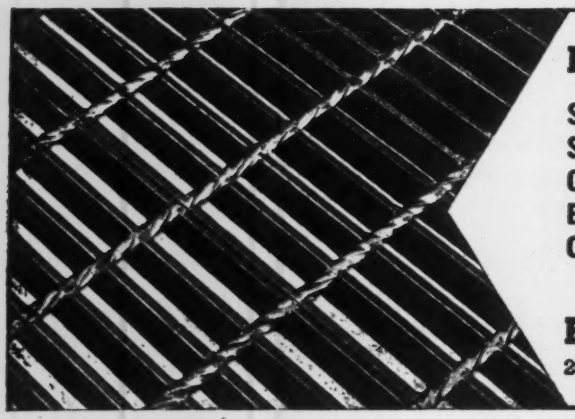
KENNEDY SAFETOP FIRE HYDRANT

direction in responsible hands. A. C. Seyfarth, formerly advertising manager, and C. E. Johnson, assistant, assume direction of the Consumer Relations department. Divisions apart from advertising are Farm Practice Research, Market Analysis, Sales Promotion, Advertising Material, Parts Catalogs and Instruction Manuals, Education and Training, War Products Service, and Canadian and Export.

THE R. D. COLE MFG. CO., Newnan, Ga., recently received the Maritime Commission's "M" award for excellence in war production. E. G. Cole, president of the company, one of Georgia's oldest steel plate fabricating plants which was converted to make prefabricated ship parts, received the award in behalf of the employees and management.

J. FREDERIC WIESE has been elected vice-president of the Lukens Steel Co., Coatesville, Pa., it has been announced by Robert W. Wolcott, president. Mr. Wiese will be in charge of the combined sales of Lukens and its two subsidiaries, By-Products Steel Corp., and Lukenweld, Inc. Since June, 1939, Mr. Wiese has been general manager of sales of the Lukens Steel Co. and in 1940 was appointed manager of the combined sales for Lukens, By-Products and Lukenweld. He was born in Parksburg, Pa., in Jan., 1899, and was educated at Swarthmore College. In Aug., 1926, he joined Lukens Steel Co. and has served continuously in its flanging, railroad and general sales departments, with the exception of a period of one year in 1928.

BLAINE S. SMITH, president of the Universal Atlas Cement Company, United States Steel Corporation subsidiary, announces the retirement Sept. 20 of Ed-



BLAW-KNOX Electroforged STEEL GRATING

SAFE—Twisted bar does the trick
STRONG—One-Piece Electroforged
CLEAN—No sharp angles to clog
EASY TO PAINT—All surfaces accessible
OPEN FOR LIGHT & AIR—Maximum open area

WRITE FOR CATALOG NO. 1887

Blaw-Knox Division of Blaw-Knox Company
2001 FARMERS BANK BUILDING • PITTSBURGH, PA.

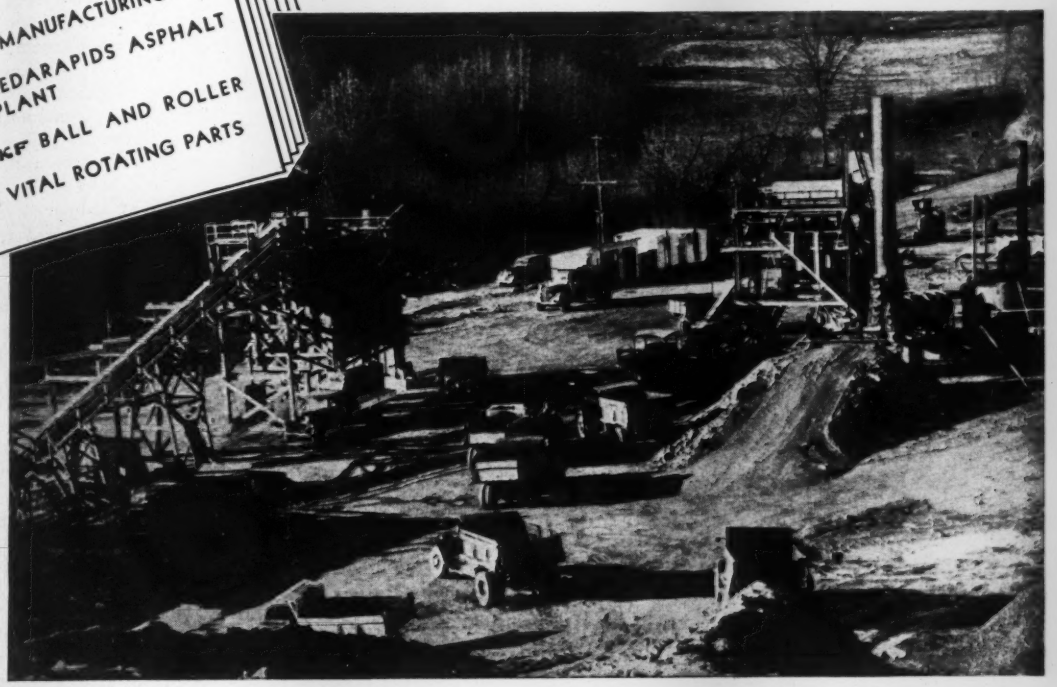
APPLICATION

Mfr. IOWA MANUFACTURING CO.

Application CEDARAPIDS ASPHALT PLANT

Bearings SKF BALL AND ROLLER

Locations VITAL ROTATING PARTS



CEDARAPIDS *Asphalt plants*

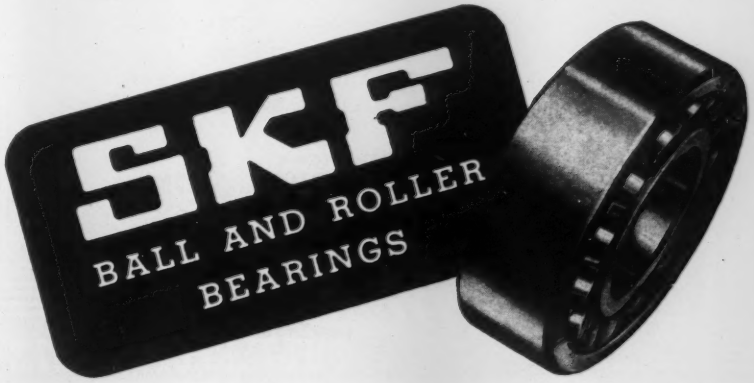
FILL THE BILL WITH SKF'S

RUGGED bearings are SKF's answer to the need for reliability on the shafts of this Cedarapids Asphalt Plant. Bearings that stand up under heavy loads. Bearings with inherent alignment that permits shaft deflections, distortions or weave. Bearings that give years of continuous good performance in exchange for occasional lubrication. Whether they're on screen, pug mill, conveyor, drier or any other part of the plant, you'll find them operating successfully despite the added demands imposed by War.

5387

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

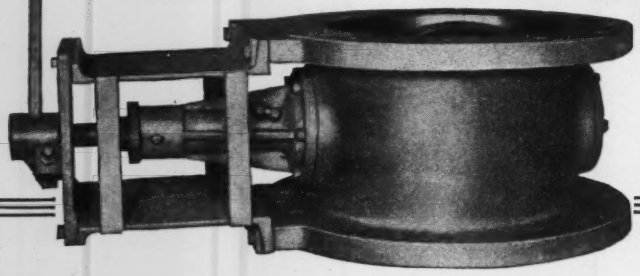
ARMY E NAVY



Wide Range of Operation

15 to 900 psi

No. 573
125-lb American Standard —hand lever control with extended stuffing box.



Consider the wide operating range of R-S Butterfly Valves. They are used for the reduction and regulation of pressure whether above or below atmosphere; to control liquid level; to relieve pressure and control back pressure; to maintain a constant differential pressure; to control rate of flow; to control combustion automatically as well as govern the output of pumps, fans, engines and turbines.

Coupled with these many uses and the inherent advantages of the R-S Butterfly Valve, are special metals for use where hard wear and severe stresses are encountered or where extreme temperatures and corrosive conditions exist. A further inducement to longer wear is the design of the valve itself. When the Butterfly vane approaches a closed position, the flow "fans out." There is no damaging "jet" effect to cause severe wear to the sidewall within a small area.

No. 586—A big 60-inch, 15-lb power-operated valve.

If your problem has to do with the control and shut-off of volume and pressure, and you are interested in simplified and less costly methods, write. Ask for R-S Catalog No. 14-B.

VALVE DIVISION
R-S PRODUCTS CORPORATION
116 Berkley Street • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

mund D. Barry, manager of Industrial Relations, after 40 years continuous service with the company, and the appointment of Gordon C. Huth, assistant manager of Industrial Relations, as his successor. Mr. Barry, a native of Boston, is a graduate of Massachusetts Institute of Technology. Mr. Huth was born in Superior, Wis., and started with the company in 1915 as a machinist helper at the Duluth plant. In 1930 he was appointed manager of safety and casualty for the entire company and became assistant manager of industrial relations in 1937. After serving several years as assistant director of industrial relations and as safety director of the United States Steel Corp. of Delaware, he rejoined the Universal Atlas Cement Co. in 1941 as assistant manager of industrial relations, now becoming manager of that department.

Timken Roller Bearing Co. will locate a branch plant in Zanesville, Ohio, it has been announced. The plant, according to Larry Hess, secretary of the Chamber of Commerce there, will employ 450 persons and will work three shifts daily.

The American Sheet & Tinplate Co. works at New Philadelphia, Ohio, has been purchased by the Westinghouse Electric & Mfg. Co., the Pittsburgh office has announced.

KEEP YOUR CONVEYOR BELTS GOING

FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

● Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.

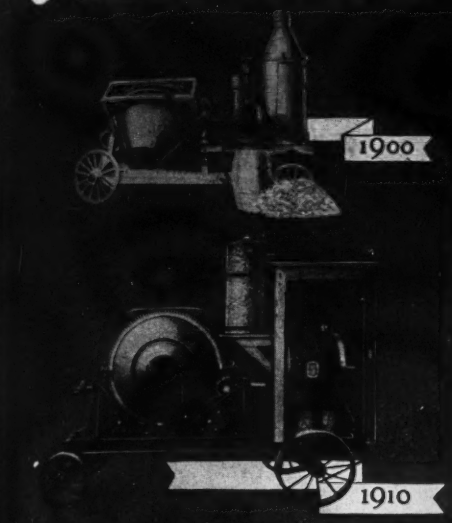
Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.

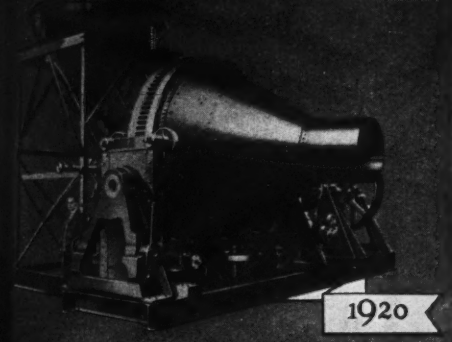
FLEXIBLE STEEL LACING CO.
4656 Lexington St., Chicago
Write for your copy.

FLEXCO HD BELT FASTENERS
Sold by supply houses everywhere

CONCRETE MIXERS by SMITH

THE T. L. SMITH CO. MILWAUKEE, U.S.A.





Every Year they become BETTER and BETTER

43 years ago, the late Mr. Thomas L. Smith designed the first duo-cone drum, tilting type, concrete mixer. Judged by today's standards it was a crude machine, nevertheless, the forerunner of the famous Smith line of concrete mixers that has made history in the construction industry. Every year, improvements and refinements were added that resulted in greater convenience, speed and efficiency. Today, Smith is the acknowledged leader in the industry. Smith Mixers have definitely proven their worth, over and over again, on the world's greatest concrete projects: *Boulder Dam, Marshall-Ford Dam, Cherokee Dam, Watts Bar Dam, San Francisco-Oakland Bridge, Norris Dam, Muscle Shoals, Panama Canal* and many other world-famous projects. All sizes available, up to 4-yards per batch.

The T. L. SMITH COMPANY
2855 No. 32nd Street, Milwaukee 10, Wis., U. S. A.

Famous for Performance on the WORLD'S GREATEST PROJECTS

SMITH EQUIPMENT

THE A.P. SMITH MFG. CO. EAST ORANGE, N.J.

Symbol of Quality Since 1889

A NAME TO REMEMBER

When you want good Water Works Equipment

It is an easy name to remember and also one worthwhile. Our experience gained in over 50 years of service enables us today to stand ready to help you get the best water works equipment available. Our men are experts in their profession and their skilled craftsmanship is known the world over.

OTHER SMITH PRODUCTS

Valves and Hydrants — Valve Inserting Machines — Tapping Sleeves — Tapping Valves — Hat Flanges and Water Meters

Write for Catalog

When You Need Any Of The Following:

WATER METERS—disc, current, disc-compound, current-compound.	Write for Booklet 42 MF
VALVES—HYDRANTS—for heavy and high-pressure service.	Write for Booklet 42 VH
TAPPING AND INSERTING VALVES, machines and accessories.	Write for Booklet 42 M
CORPORATION AND CURB COCKS, PIPE CUTTERS, REPAIR SLEEVES, REMOVABLE PLUGS, INDICATOR POSTS, ETC.	Write for Booklet 42 Misc.

Branches

7 So. Dearborn St., Chicago, Ill.
409 Texas St., El Paso, Texas
315 N. Crescent St., Flandreau, S. D.
901 Wm. Oliver Bldg., Atlanta, Ga.
524½ First Ave. S., Seattle, Wash.
1317 Oakley St., Orlando, Fla.
Easton Bldg., 13th & Broadway, Oakland, Calif.

THE A. P. SMITH MFG. CO., EAST ORANGE, N. J.

Edward K. Myers who has been credit manager for the company, has been elected assistant treasurer. J. Warren Herman is treasurer of the concern. Mr. Myers joined Lukens in August, 1930, serving in the Comptroller's Office, Cost Department and Treasury Department, until his appointment as Credit Manager in 1940. He was born in Ephrata, Pa., and studied at the Wharton School of the University of Pennsylvania.

CHARLES BUCKINGHAM, 79, has retired from the Seymour Manufacturing Co., Seymour, Conn., after 63 years of consecutive service. He became an employee three years after the company was organized, and for 60 years he has served as shipping clerk.

RAYMOND C. COSGROVE, vice-president and general manager of the manufacturing division, The Crosley Corp., has engineering and direct charge of the manufacturing of Crosley's war products. He is a member of the board of directors and the executive committee of The Crosley Corp. Long associated with the Westinghouse Electric & Mfg. Co., Mr. Cosgrove is widely known in the electrical appliance field. He is a graduate of the Carnegie Institute of Technology, where he specialized in commercial, mechanical and electrical engineering. At one time he was in charge of the sales promotion for all the Westinghouse home appliances. In 1932 he became manager of the refrigerator department and, more recently, assistant sales manager of the merchandising division.

meet SPECIAL NEEDS

Bulky, cumbersome machinery, and of late heavy pieces of defense equipment must be moved from place to place.

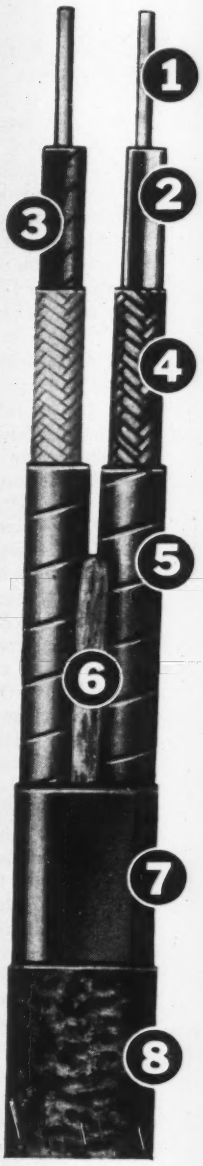
In some localities, where low headroom is encountered, this type of Rogers Trailer is used extensively.

Large machines, with crawler treads "straddle" the girders thus lowering the overall height by several inches, a definite advantage also in handling many kinds of equipment.

ROGERS BROTHERS CORP., ALBION, PENNA.

To Expedite War Purpose Wiring *Use* G-E BRAIDX

(NON-METALLIC SHEATHED CABLE)



Notice Rugged Composition of G-E BraidX

1. Coated copper conductor
2. Code insulation ("Hot Conductor")
3. Type EG (paper) insulation (Neutral Conductor)
4. Petersen paper and cotton moisture-resisting braid
5. Spiral paper armor
6. Jute fillers
7. Paper wrap
8. Moisture-resisting and flame-retarding over-all braid (new gray finish)

G-E BraidX can be used to distribute power in factories, shops, mills, etc. Install it instead of rigid conduit, EMT or BX except in hazardous or wet locations. It is ideal, too, for open or hidden wiring in war buildings. It is available with two or three conductors in sizes 14 to 4. It is also available with an additional non-insulated grounding conductor.

G-E BraidX is suitable for maintenance work . . . for wiring additions . . . and for new war-purpose wiring. It is strongly insulated, carefully cabled and covered over-all with a moisture-resisting and flame-retarding braid. The braid has a new gray protective finish which makes G-E BraidX clean to handle.

G-E BOXES AND FITTINGS

There is a wide variety of G-E boxes and fittings suitable for use with G-E BraidX. These boxes and fittings are easy to use and will give dependable service. Only a few can be shown here.

FOR FURTHER INFORMATION on G-E BraidX, building wires or wiring devices see the nearest G-E Merchandise Distributor or write to Section CDW-1038-113, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

G-E BUILDING WIRES AND WIRING DEVICES

Included in the G-E line are building wires and wiring devices for every purpose: Flamenol Type SN small diameter building wire with thermo-plastic insulation, other wires and hundreds of switches, lampholders, outlets, etc.

GENERAL ELECTRIC

OUR PRODUCTION TODAY has an important meaning for tomorrow

★ Equipment we made before the declaration of war has proved to be valuable for the war effort. The standard NOVO line still continues to be produced — we were never required to change our set-up, our machinery, our manpower to any extent, or our distributor set-up. In other words, we went from peace-time production to that of war-time, making the same equipment for Uncle Sam. Our only change was to increase our effort, for more and more NOVO equipment continues to be needed.

In this regard NOVO distributors have been of tremendous assistance in getting NOVO equipment to new plants, air fields, training bases, ship yards, new roads, etc. They have also kept NOVO units operating.

Looking ahead we point out at this time that standard NOVO equipment will be in production and immediately available at the turn between the present emergency and post-war activities.

In the meantime, we suggest that you use the coupon and get full details on the NOVO line.

NOVO SEE A NOVO DISTRIBUTOR

ENGINE CO.
LANSING, MICHIGAN

WE ARE IN PRODUCTION ON--

Diaphragm and Pressure Pump

Light Plants

Hoists

Self-Priming

Engines

Pavement Breakers

NOVO ENGINE CO.—200 Porter Street, Lansing, Mich.
Send information on Novo Diaphragm Pumps ☐
Self-Priming Centrifugals ☐ Pressure Pumps ☐ Hoists ☐
Light Plants ☐ Pavement Breaker ☐ Engines ☐
Name _____
Address _____
City _____ State _____

He served in World War I. with the 309th Field Engineers, 84th Division.

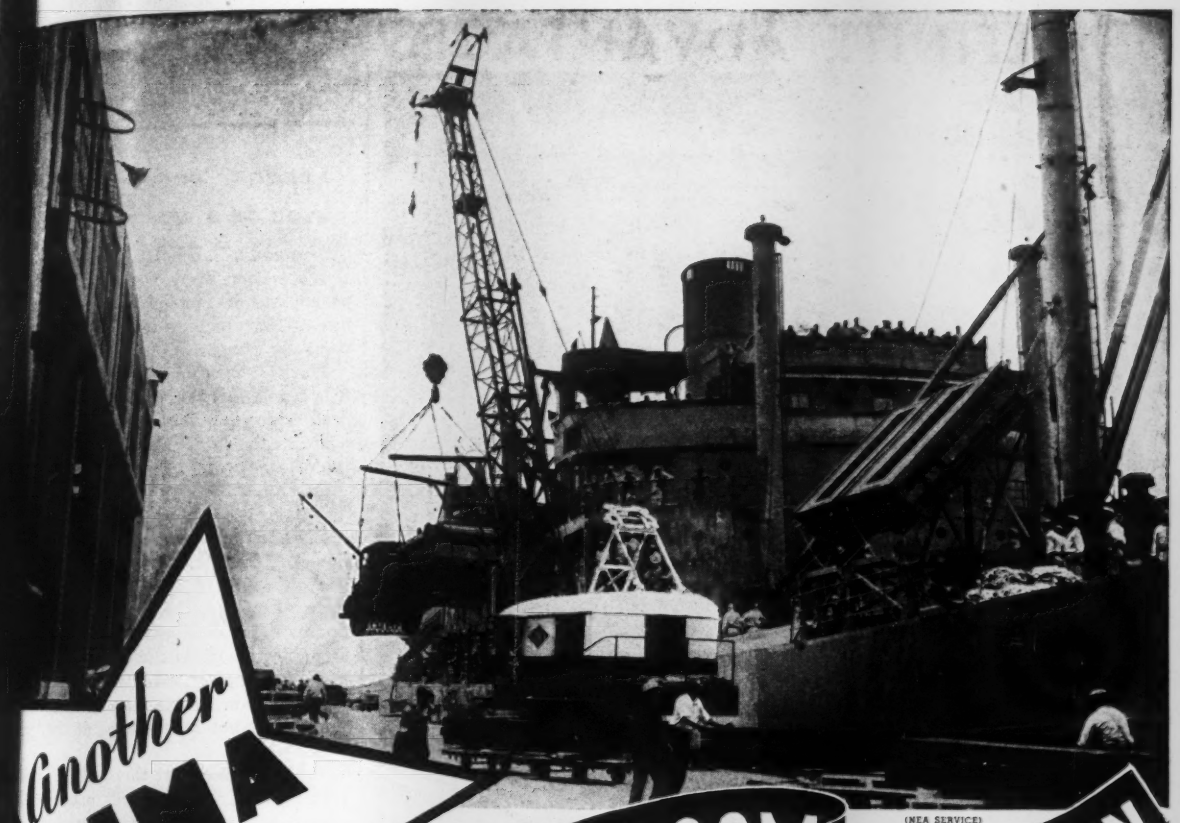
DAVID MACGREGOR has been appointed chief engineer of the Edward Valve and Mfg. Co., Inc., East Chicago, Ind., with which company he has been associated in various engineering capacities since 1925. MacGregor was education in Scotland and took additional engineering training at the Illinois Institute of Technology and at Purdue University.

THE KOTAL CO. of New York has announced the appointment of Francis E. Smith, Jr., as sales manager. Mr. Smith has been active in the asphalt industry for 26 years. Originally associated with his father's firm, Dow & Smith, paving consultants of New York, Mr. Smith later served the Texas Co. and then the Union Oil Co. of California, becoming manager of the asphalt department. Their extensive foreign interests took him to China, Japan, Australia, the Philippines, and other foreign fields. Mr. Smith organized his own contracting firm, Smith & Day, of Los Angeles, Calif., which engaged in West Coast paving construction until the wartime restriction of asphaltic materials. As a senior business specialist to the Office of Price Administration and the Petroleum Administration for War, Mr. Smith compiled the Maximum Price Regulation No. 323 working with the asphalt industry.

CHARLES B. MCCOY has been named director of sales of the explosives division, it was announced by the E. I. du Pont de Nemours & Co. He had been serving as director of chemical and miscellaneous sales. In his new position, all sales of the explosives division will be in his charge. Mr. McCoy succeeds Samuel G. Baker, who has been made manager of the company's electroplating division.

DONALD M. HOUGHTALING, former assistant service manager of the Novo Engine Co. of Lansing, Mich., was recently promoted to the position of manager of the same department. He fills the vacancy caused by the death of the former service manager, Joyce Humphrey.

JOHN R. CASSELL COMPANY, INC., of New York City, dealers in drafting supplies and technical reproduction processes and materials, has announced the establishment of an industrial photographic materials department, in line with the trend to employ photographic contact printing and projection equipment.



(NEA SERVICE)

Another LIMA feature

HOIST, SWING, TRAVEL and BOOM UP or DOWN

ALL AT THE SAME TIME

Today when we are working to hasten Victory it is important that we use every known means to speed up the handling of material vital to our war effort. To this end LIMA cranes of 20 tons capacity and larger, which will hoist, swing, travel and boom up and down at the same time are great time savers. Simultaneous operations speed up production because there is no lost time changing from one motion to another. Loads are spotted quicker, machine can work in much closer quarters and less frequent moves are necessary. These advantages should be considered when you have a job that requires speed and precision. Make your next shovel, crane or dragline a LIMA, and get a machine that has won the indorsement of those who are doing the big jobs.

LIMA LOCOMOTIVE WORKS, INCORPORATED

Shovel and Crane Division LIMA, OHIO

NEWARK, N.J. NEW YORK, N.Y. DALLAS, TEXAS PORTLAND, ORE. SEATTLE, WASH. SPOKANE, WASH. SAN FRANCISCO, CALIF. LOS ANGELES, CALIF. PHILADELPHIA, PA. MEMPHIS, TENN.

SHOVELS
CRANES
DRAGLINES

LIMA

SHOVELS, ¾ YD. TO 3½ YD. CRANES, 13 TONS TO 65 TONS
DRAGLINES, VARIABLE

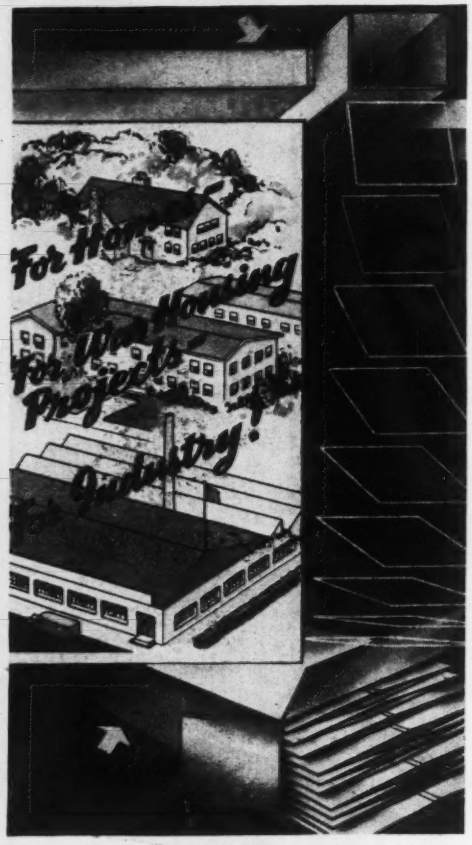
7 DEFINITE ADVANTAGES

ARE COMBINED IN

SAL-MO SUPPLY DUCT

for

WARM AIR HEATING, VENTILATING and AIR CONDITIONING SYSTEMS



1. Each SAL-MO SUPPLY DUCT carries the Underwriters' "INSPECTED" label for Heating, Safety and Permanence.
2. The unique folding feature of this DUCT saves space in cars, storage and transferring to jobs.
3. SAL-MO SUPPLY DUCT embodies built-in insulation, insuring years of fuel saving.
4. Superior lightness (less than 8 oz. per square foot) combined with superior strength (Mullens. Test over 400 lbs. per square inch) assure ease in handling and structural stability.
5. Fabricated entirely with insoluble adhesives, weather and high humidity cannot affect it.
6. Manufactured in 26 standard sizes (Areas from 26 square inches to 448 square inches—in 4-foot, time saving lengths) allowing for all types of installation.
7. Also furnished in flat sheets containing from 11 to 24 square feet which can be easily rolled or scored on the job.

SALL MOUNTAIN COMPANY

176 West Adams Street **Dept. H** **CHICAGO 3, ILL.**

BAILEY METERS AND CONTROLLERS

FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY

1029 IVANHOE ROAD ● CLEVELAND, O.

Bailey Meter Co. Ltd., Montreal, Canada

ERIE

DOUBLE SUCTION TYPE S CENTRIFUGAL PUMPS

BELT MOTOR OR ENGINE DRIVE

Sizes From 2" to 12"

Write for Bulletin No. 38

ERIE PUMP & ENGINE WORKS

152 Glenwood Ave. Medina, N. Y.

NEWS OF THE WEEK

(*Continued from p. 73*)

London "underground" used as a war plant

Five and a half miles of subway tunnel and a station sixty feet below the busy pavements of London have been turned into a war factory manufacturing vital parts for combat aircraft.

Workers turn out these instruments on benches stretching down the roadbed on both sides of the station. Glassed-in offices and other work shops and tool rooms are established on the station platforms.

Two years ago the site of this underground factory was an uncompleted section of the "Underground," London's subway, full of mud, dirt and unlaid slabs of concrete. Early in 1941 German bombs fell perilously close to a large airplane factory in the vicinity. One section of this plant made small but important airplane parts on machine tools that could not be replaced if they were destroyed.

It was feared that the Germans would return, so it was decided to convert the tunnel and station into an auxiliary factory where the precious machine tools would be safe from bombs.

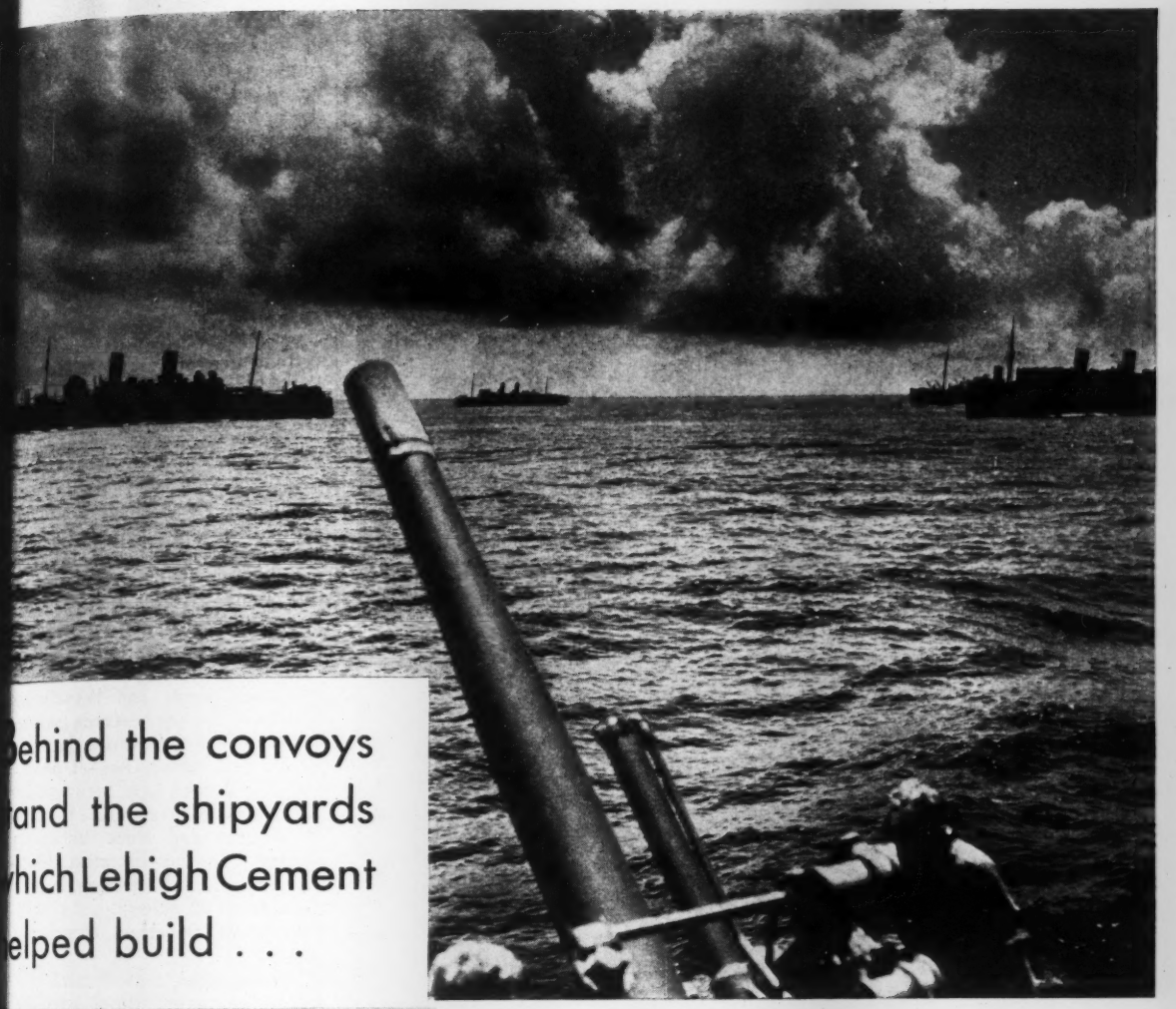
. . .

St. Paul's truck zoning upheld by the ODT

The Office of Defense Transportation has declined to ask the City Council of St. Paul, Minn., to modify its ordinance restricting truck movements to certain streets in the city for duration of the war. Under this ordinance trucks of over 2-tons capacity are restricted to certain streets and districts except where making deliveries. This trucking ordinance complements the comprehensive zoning ordinance of the city. Trucks are permitted on all streets zoned for commercial or industrial uses, and also certain specified routes through the city.

Opponents criticized this ordinance as a waste of transportation equipment and rubber and asked the Office of Defense Transportation to arrange for some relaxation for the duration of the war.

A request from the ODT for such modification was referred by the city council to the St. Paul Planning Board, the originators of the trucking ordinance. The board advised the ODT of the advantages of the trucking ordinance to people living in areas zoned for single family houses, and pointed out that no



ehind the convoys and the shipyards hich Lehigh Cement elped build . . .

HIGH EARLY STRENGTH CEMENT

service-strength concrete in a hurry

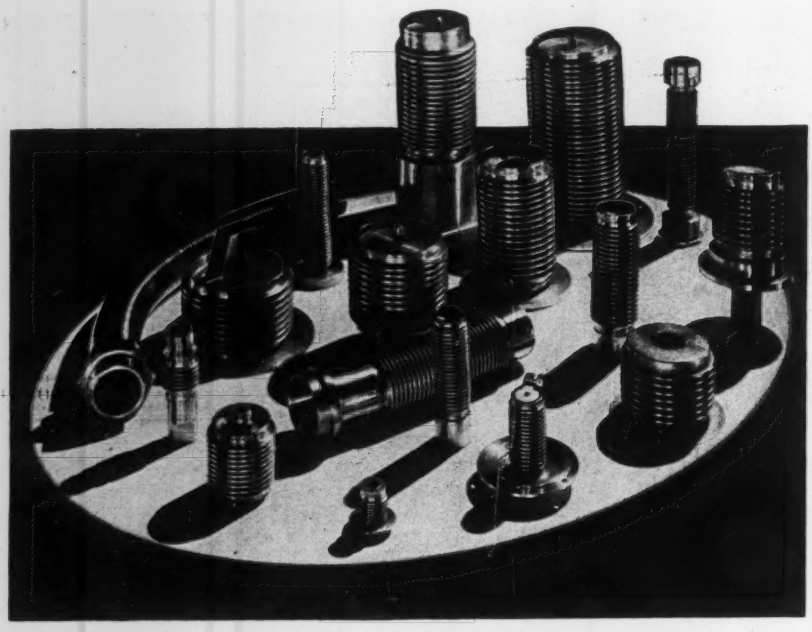
Lehigh CEMENT

MINUTES are precious in shipyards today. Vessels to carry world-wide cargoes, and fighting ships to guard the sea-lanes, are being turned out at amazing speeds. That's only possible with the help of every American industry, and Lehigh Cements share the job.

Concrete for vital shipyard installation is quickly and efficiently made with Lehigh Portland Cement. In cases where speed is of the essence, Lehigh Early Strength Cement comes to service-strength 3 to 5 times faster than normal cement, and gives a finer, denser concrete, too.

There's a place for Lehigh Cements in every industry, whether for war or private work. Lehigh's Service Department specializes in solving special problems. Why not write and let us help you?

EHIGH PORTLAND CEMENT COMPANY • ALLENTOWN, PA. • CHICAGO, ILL. • SPOKANE, WASH.

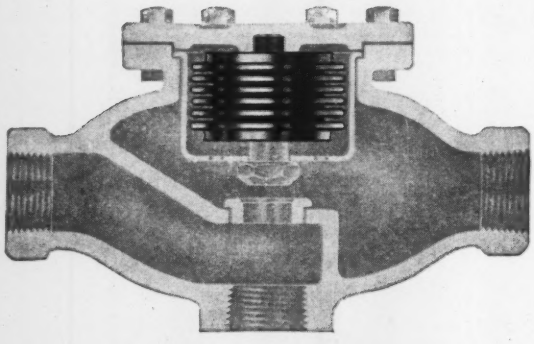


CMH
Stainless Steel Bellows

Wherever stainless steel's corrosion resistant qualities and temperature values are required in bellows service, CMH unimetal **circular seam welded** assemblies are filling that need.

No Solder or Flux Required

Long lengths of CMH Bellows are standard production; strength is further enhanced with **multiple ply** assemblies when needed.



Ask for engineering recommendations on specific applications.

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Illinois

truck has to go out of its way in lea the city in any direction. Following ceipt of this report the ODT adv the board that it is of the opinion the ordinance is a reasonable one, therefore, it will not ask for its m fication.

. . .

City transportation poo inaugurated in Michigan

Reduction of car and truck milea by at least 40 percent over the 1 total is being effected in at least Michigan cities and villages through coordinated plan of municipal tra according to a report by the Ameri Municipal Association. Practically municipalities cooperating in the p gram report substantial reductions travel. Municipally owned cars, hou in a municipal garage in Saginaw, h been substituted for private cars merly used for city business. Highl Park has made a detailed analysis of municipal needs and has allocated portion of the equipment in each dep ment for stand-by service. In the pub works department, two of seven ca and four trucks have been retired fr active service, decreasing car mileage 41 percent and truck mileage by percent. In the sanitation departm driving is down 31 percent, in the wa department 62 percent, and in the poli department 20 percent, according to t report.

Several other controls used in Mic gan cities to cut travel costs includ use of horse-drawn snow plows inste of mechanical brooms; scheduling wo of building, electrical and plumbing i spectors so all use one car; and patr ling of city streets every second ho and elimination of cars for water me readers.

BRIEF NEWS

A decline in passenger car regist tions this year to less than the to recorded at the beginning of the war 1939 is indicated by registration da from 39 states for the first half of 19 the Public Roads Administration of t Federal Works Agency has announce The Roads Administration estimates th a little over 25 million automobiles w be registered in 1943 as compared wi a little over 26 million in 1939.

A $2,000,000 connecting highway planned for western Pennsylvania's $ 000,000 airport now under construct in Moon Township, Allegheny Coun

your silent partner

Prior to 1939, all ore from the vast Mesabi iron range—largest iron producing area in the world—moved from pit to dock by rail.

Today, a conservatively estimated 30 to 40% of the Mesabi's total tonnage—now greatly increased to meet war-time demands—rolls on rubber . . . in giant trucks, *of which the large majority are Cummins Diesel-powered!*

If your job is commercial fishing, petroleum production, logging, highway or waterway transportation, construction, mining or one of many others in which the Cummins Dependable Diesel has been so long established, you'll readily understand why this particular diesel is so widely used on the iron range.

But, regardless of what your job may be, you know that iron ore and the steel it produces is the backbone of all industry. Thus, in helping to produce ore from the Mesabi—*faster and cheaper* than it's ever been produced before—Cummins Diesel power has become a silent partner on every war job in America . . . working always toward one end . . . working always toward Victory. CUMMINS ENGINE COMPANY, Columbus, Indiana.

While new engines are scarce, try to "make the old ones do" by careful maintenance and service. Your Cummins dealer is eager to help and his complete service facilities are available day and night.

APS
PROTECTED STEEL
ROOFING and SIDING
...available now!

Protected against weather extremes
... from the winds and snows of the Aleutians to the tropical sun and rains of the Canal Zone.

Easy to erect
The steel core provides a sheet strong and rigid, yet light enough in weight to be easily handled and erected.

Withstands acid fumes and salt air
...made possible by exclusive, chemically inert, A P S Weather-Tested coating.

Needs no painting
The exterior mica coating is attractive, durable, and minimizes maintenance.

Jobbers Coast to Coast

PROTECTED STEEL PRODUCTS CO.
General Office and Plant,
WASHINGTON, PA.

Already $5,120,000 has been spent or contracted for on the airport. The 1,128-acre site has three mile-long runways that can be extended several thousand feet. When completed, the airport, it is said, will be one of the most modern in the world. It will feature passenger and freight service, plus "helicopter shuttle service." The government paid all expenses except the $278,976 cost of the land. After the war it will turn the field over to Allegheny County for maintenance.

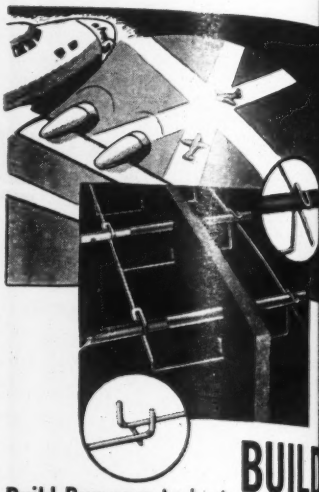
The first Army-Navy E for construction awarded in Texas was presented Aug. 11 to the Austin Road Co. of Dallas, for its work on the $2,000,000 airdrome at the Galveston Army Air Base, which was finished a month ahead of schedule.

Additions to the municipal sewer system at Fayetteville, N. C., have been completed at a cost of about $370,000. The project, which included 97,500 ft. of sewer lines to serve public and private housing developments for civilian war workers and families of servicemen, was begun last April and is part of a $1,101-000 construction program which includes extensive additions to the municipal water system. Projects, which are nearing completion include a 3,000,000-gal. filtration plant and the installation of approximately 104,000 ft. of water distribution mains. The filtration plant is expected to be ready for operation Nov. 15.

A preliminary state trunkline maintenance budget of $9,933,805 for the fiscal year which began July 1 has been authorized for the Michigan State Highway Department. Routine road and bridge maintenance accounts for almost five million dollars of the total; road services such as snow removal, dust laying, traffic control and bridge operation for another two and a half million dollars; and extraordinary maintenance and heavy repairs, $2,408,000.

The completion of approximately 30 miles of road through Hays, Caldwell and Bastrop counties, Tex., will close another gap in one of the nation's most historic highways, the Old San Antonio Road. This first definite route of travel in Texas was established by an expedition under Capt. Domingo Ramon in 1716, according to J. M. Owens, district engineer, Texas Highway Department. The establishment of missions at what is now San Antonio in 1718 probably served definitely to mark this road as a travel route. It later became known as El Camino Real (King's Highway), and is now known as the OSR (Old San Antonio Road).

A plan has just been submitted to



Build Runways to Last and BUILD FAST

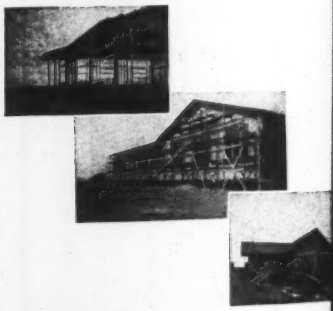
with UNION "QWIK-LOCK" Expansion Joint Assemblies

● To speed up airplane runways construction—and assure an enduring job—use "Qwik-Lock" Expansion Joint Units. They simplify dowel installation... make it easy to lock and align dowels accurately. Designed for fool-proof, trouble-free functioning.

UNION STEEL PRODUCTS COMPANY
417 Berrien, ALBION, Mich.

Write for Catalog of Construction Accessories. See Our Section in SWEET'S.

HOUSING FOR OIL MEN IN VENEZUELA



The photos above show various stages of construction of a large number of houses built of Stran Steel and "GUNITE", to our specifications, at the San Tome Terminal of the Mene Grande Oil Company, C. A., Venezuela.

★ ★ ★ ★ ★ ★ ★ ★ ★

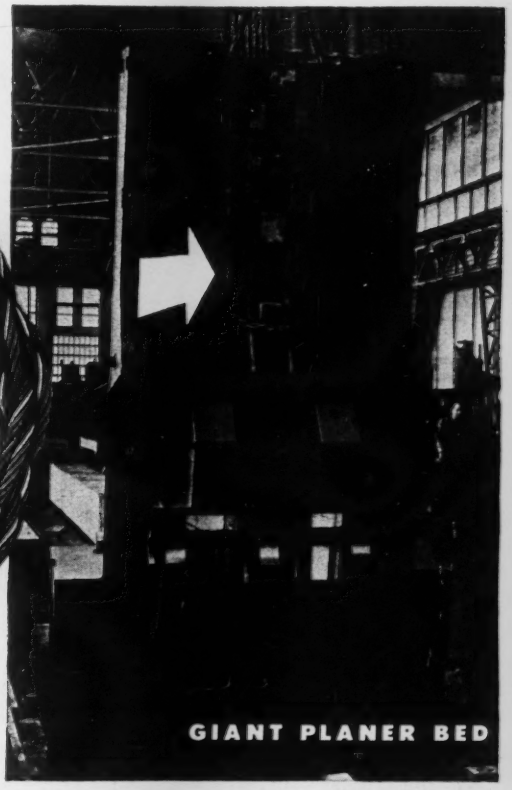
Our Bulletin 2200 illustrates and describes many similar cases of building with "GUNITE" as well as numerous other applications. Send for a copy today!

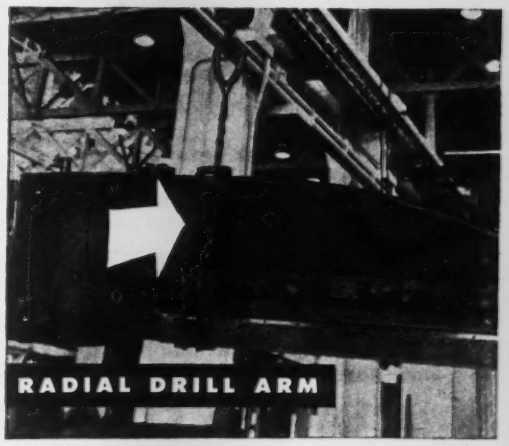
The "CEMENT GUN" can be bought by anyone, and used without restrictions.

CEMENT GUN COMPANY
Manufacturers of the "CEMENT GUN"
ALLENTOWN, PENNSYLVANIA
WE ARE ALSO "GUNITE" CONTRACTORS
LET US BID ON YOUR WORK

How to Get Help on 2 SLING Problems

- **Shortage of MANPOWER for heavy lifts**
- **Shortage of MANILA ROPE for light lifts**


GIANT PLANER BED


RADIAL DRILL ARM

Would it help you, on a 20- or 25-ton lift, to have a sling that *one* man could handle, instead of two or three? Light weight is just one work-speeding advantage of Yellow Strand Braided Wire Rope Slings.* They're easy to attach . . . kink-resistant . . . free from corkscrewy effects—all because the patented braiding makes them flexible and relaxed. Still they possess the strength and uniformity of tough Yellow Strand Wire Rope. Employees like this *security*.

Not all sling difficulties have been problems of manpower or heavy loads. Many *light* sling users, deprived of Manila rope, are discovering that versatile Braided Yellow Strand Slings are pliable . . . responsive . . . safe for handling fragile, slippery or highly finished objects. Again it's the patented braiding that provides a soft, sure grip. As you check the wartime efficiency of your sling methods, let Broderick & Bascom's specialized Sling Engineers be of service. Write now.

Broderick & Bascom Rope Co., Saint Louis

Branches: New York, Chicago, Houston, Portland, Seattle
Factories: St. Louis, Seattle, Peoria

*Patents: U. S., 1475859, 1524671, 2142641, 2142642; Canadian, 252874, 258068

Riggers' Hand Book—Shows sling types, fittings, capacities. Send for FREE copy.

3-TIME WINNER

ARMY E NAVY

BRODERICK & BASCOM

YELLOW STRAND

aided Wire Rope **SAFETY SLINGS**

"Giving it the GLUE GUN"

HERE'S the operation that's saving critical nails, speeding construction and developing new structural strength in hundreds of different wartime building jobs today . . . laying down a ribbon of Laucks Construction Glue with a Laucks Glue Gun.

This operator is making a floor assembly for army overseas housing units. The plywood floor will be affixed on top of this insulated frame section in another moment . . . making a rigid, stressed cover assembly that can "take it" in transportation and in service.

It's just another example of applying more than 20 years of gluing knowledge to a specific construction problem . . . the kind of practical "know how" that's made I. F. Laucks, Inc., the world's largest manufacturers of water-resistant and waterproof glues.

Investigate what Laucks Glue and Laucks counsel can do for you . . .

I. F. LAUCKS, Inc.

Lauxite Resins — Lauxein Glues

CHICAGO, 2 — 6 North Michigan Avenue
LOS ANGELES, 1 — 859 E. 60th Street
SEATTLE, 4 — 911 Western Avenue

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Seattle, Los Angeles, Portsmouth, Va., Lockport, N. Y.

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HERCULES-LAUX-MERRITT, Ltd., Stanbridge, Quebec

● Don't forget, LAUX REZ, the pioneer resin sealer and primer, protects wood as rust-proofing protects metal.

LAUCKS CONSTRUCTION GLUES

Consult LAUCKS—America's Glue Headquarters

Governor J. M. Broo[illegible]on of North C[illegible]olina calling for all [illegible]ties and coun[illegible] in the state to pool [illegible]ir road build[illegible] equipment with that [illegible] the state so [illegible] the maximum amoun[illegible] of machinery [illegible] equipment will be m[illegible]e available to [illegible] state or local gove[illegible]ment unit wh[illegible] might need it. The p[illegible]an was offered [illegible] Mayor George W. Coan, Jr., of Winst[illegible] Salem, N. C., in connection with an [illegible] tensive road construction program wh[illegible] the governor outlined for North Caro[illegible] as soon as labor and materials are av[illegible] able.

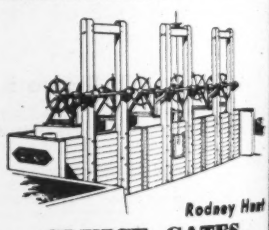
New classes in civil engineering [illegible] tuition-free courses, sponsored by [illegible] United States Office of Education and [illegible] Texas universities, have been opened. [illegible] the University of Texas' 11-week jun[illegible] engineering course men and women [illegible] tween 18 and 43 years old who were gr[illegible] uated from highschool in the upper qu[illegible] ter of the class or who have a ye[illegible] college education can qualify. South[illegible] Methodist University's 12-week civil en[illegible] neering course opened new classes [illegible] Sept. 27 and 28. Jobs open to gradu[illegible] of these war courses are in the state hi[illegible] way department, and in shipyards.

The U. S. Engineers have orde[illegible] owners of Pittsburgh's $100,000 float[illegible] night club, the "Yacht Club," wh[illegible] sank in the Monongahela River recen[illegible] to remove the boat. The "Showboat," [illegible] it used to be called, sank sideways i[illegible] the river off the Golden Triangle busin[illegible] district between the Wabash Railr[illegible] bridge and the Point bridge, when [illegible] employee failed to man the pumps wh[illegible] kept the boat afloat. Engineers say [illegible] derrick boat will be required to [illegible] mantle the Yacht Club. Meanwhile, [illegible] boat has been sinking deeper into [illegible] river, and engineers fear it might beco[illegible] a navigation hazard.

The new 1,417-ft. bridge carry[illegible] United States Route 1 across the Rap[illegible] hannock River at Falmouth, Va., [illegible] opened to traffic recently. Traffic has b[illegible] detoured since June when the old [illegible]

Hayward Buckets

Use this Class "E" Clam Shell Bucket for handling crushed stone, gravel, sand and other bulk materials.
THE HAYWARD CO., 48-50 Church St., N. Y.



Rodney Hunt

SLUICE GATES

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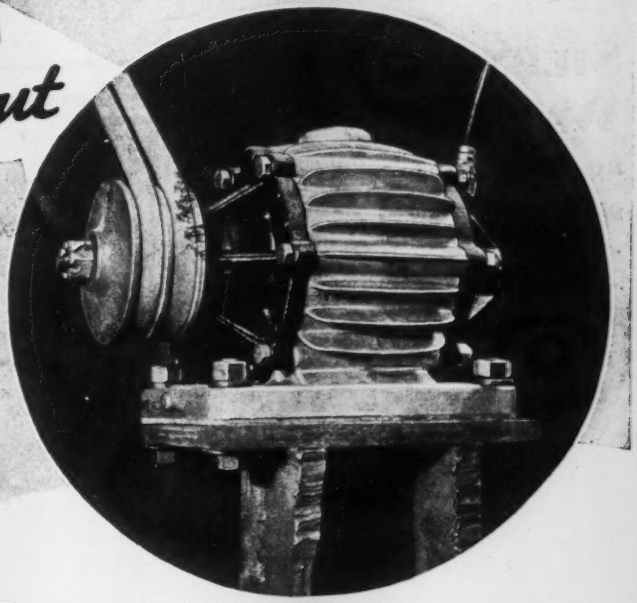
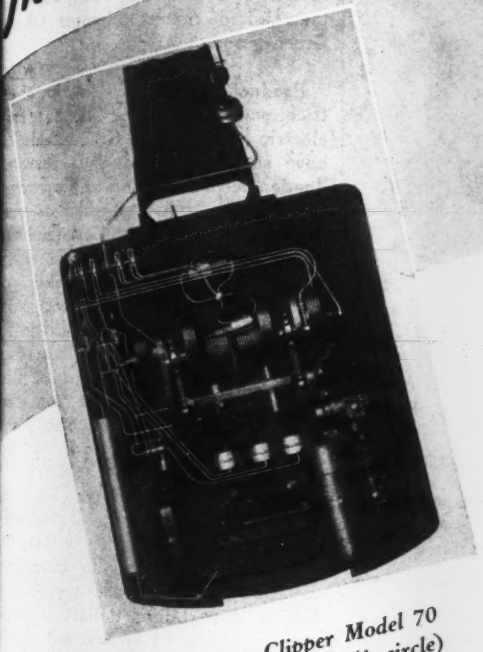
ON A BUCKEYE CLIPPER SHOVEL

The Operator Gives the Orders —

This carries them out





Machinery deck of Buckeye Clipper Model 70 ¾ yard shovel, showing Vacuum Pump (in circle) on engine and vacuum tank supplying piston and diaphragm type vacuum cylinders which control every operation on crane, trench hoe or dragline.

Clipper operators have a snap. A light touch on small handles—six in all—puts the shovel through its paces and *the vacuum pump, heart of the Mevac metered vacuum control system, does the work.* No tugging and shoving of long levers. No wonder Clipper operators, in uniform and out, handle more yardage daily, without fatigue.

This same pump supplies the vacuum that applies the swing brake automatically, trips the dipper, controls all brakes and clutches, and in fact controls all operations.

Vacuum power control is smoother, increases the service life of brake and clutch linings; in fact sets a new low for shovel maintenance costs.

Buckeye Traction Ditcher Co., Findlay, Ohio

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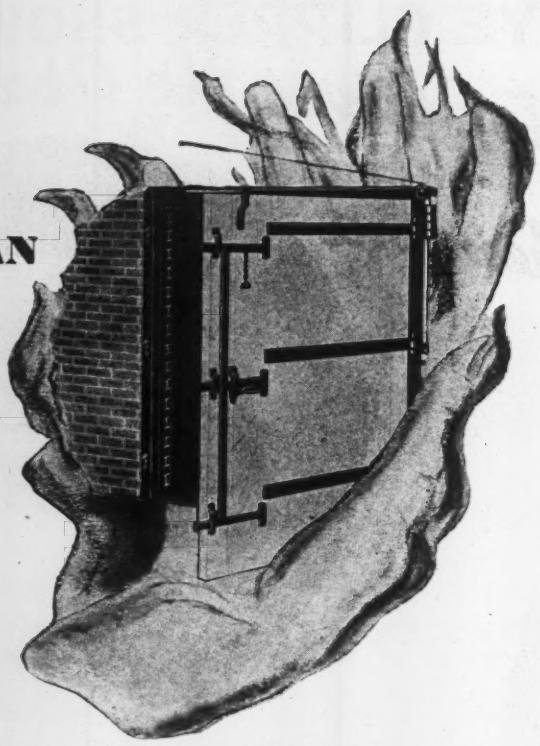
Buckeye

CONVERTIBLE SHOVELS, TRENCHERS, BACKFILLERS, TRACTOR EQUIPMENT, CRANES AND POWER CONTROL UNITS

SILENT WATCHMAN
against spreading fires



PROTECT your buildings with the NEW Richmond Fyrgard Door

The hand of fire impedes production! Fire simply can't run amuck through your plant with the NEW Richmond Fyrgard doors on guard Designed to meet the strictest Underwriters and Building Code laws, they fit any specification Available in automatic closing, single and double swing doors, inclined or level track automatic sliding Built to the highest standards of quality and protection. =24 gauge galvanized steel with vertical cap seams of =22 gauge steel, covers a core of three-ply white pine tongued and grooved. Flush galvanized sheets of the NEW Fyrgard Door eliminate all horizontal seams, making a better appearance The heavier metal provides a more durable surface than the usual 30 gauge terne plate on tinclad doors.

Protect your plant and your production against spreading fires with the NEW Richmond Fyrgard Door. They give you the greatest possible safety! Write for details and specifications. See our catalog in Sweets.

Richmond FIREPROOF DOOR COMPANY

(Affiliated with the Peelle Company, Brooklyn, N. Y.)
RICHMOND, INDIANA

mouth bridge was d[illegible]utled to per[illegible] building of the final [illegible]ns of the ne[illegible] bridge. The structur[illegible]ad been und[illegible] construction for nea[illegible] two years. T[illegible] bridge has been bui[illegible] by the Bowe[illegible] Construction Co., R[illegible]gh, N. C. T[illegible] bridge, which cost $55[illegible]00, is 52 ft. wi[illegible] and has a 40 ft. roadbed.

For completing their projects in o[illegible] structing the Smith Reynolds Airport [illegible] Winston-Salem without any accident which caused the loss of manpower, pr[illegible] ject managers of the Southeastern Co[illegible] struction Co. of Charlotte, N. C., we[illegible] awarded the honor of "Foreman of th[illegible] Month" recently for two successi[illegible] months by the resident safety engineer [illegible] the United States Engineer Office [illegible] Greensboro.

Producing 16,000,000 kw. hr. of ele[illegible] trical energy in 24 hours, the huge hydr[illegible] electric generators at Grand Coulee da[illegible] have smashed all previous power pr[illegible] duction records in the world's potential[illegible] greatest power house, which at prese[illegible] has in operation about one-third of i[illegible] ultimate installed capacity. Theoretically[illegible] the power load demand carried by th[illegible] giant machines was sufficient to ha[illegible] illuminated two 60-watt electric lig[illegible] globes in every home in the United State[illegible] However, power developed at Gra[illegible] Coulee dam is absorbed domestically[illegible] and industrially at many points in th[illegible] Pacific Northwest.

Brady Gentry, chairman of the Texa[illegible] Highway Commission and president [illegible] the American Association of State Hig[illegible] way Officials, sponsors an American A[illegible] sociation plan that calls for an authoriz[illegible] tion of three billion dollars to rehabil[illegible] tate war-battered American highway[illegible] after the war. The plan is said to ha[illegible] the double value of rehabilitating th[illegible] American highway system, which w[illegible] have suffered great punishment fro[illegible] extra wartime use, and of assisting po[illegible] war national economy by providing wo[illegible] for around a million skilled and unskille[illegible] workers.

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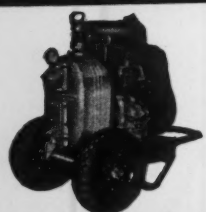

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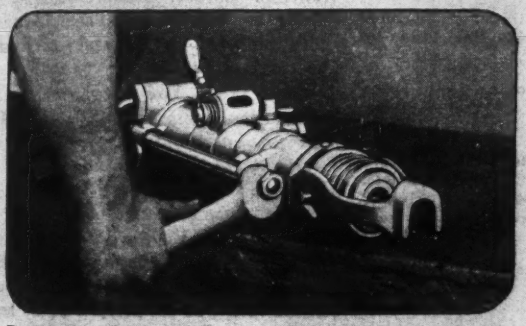
Elementary Care of C-P Sinkers

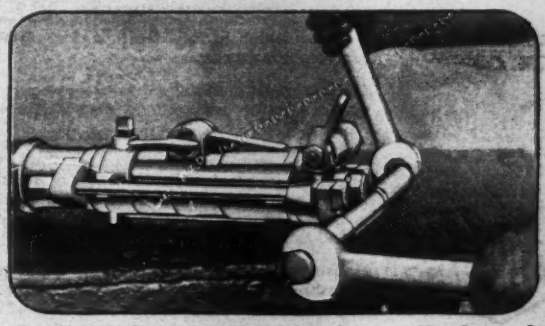
KEEPS THEM AT TOP SPEED

CP Rock Drills are noted for fast drilling, but to keep them operating at their best they should be lubricated and tightened regularly. Drilling speed for example will be lost if side rod nuts are loose or unevenly tightened. This may pinch valve and chuck parts, and cause drills to leak air. Give your CP Sinkers simple, intelligent care, particularly as suggested below.

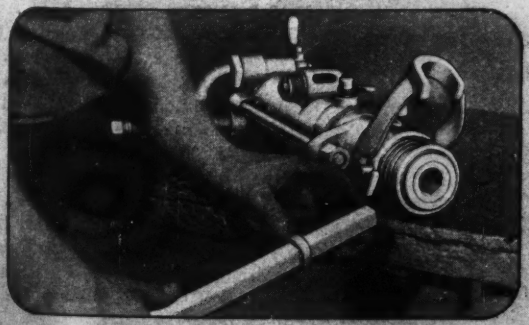
HOW TO GET MAXIMUM SERVICE FROM YOUR CP SINKER DRILLS



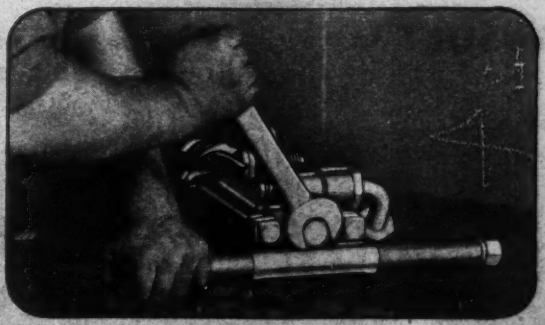
1 Keep side rod nuts evenly tightened. Check weekly to maintain economical performance.



2 Handle bolt nuts should be kept well tightened in order to facilitate the handling of the drill.



3 Too long or too short drill shanks will affect piston travel and cut down the drilling speed.



4 If drilling wet, keep water tube plug tight so water cannot enter cylinder and wash out oil.

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ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

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for Concrete Construction

In view of relaxed restrictions on concrete structures Hausman is in a position to release from stock removable steel forms for concrete construction.

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Hausman service is unique and includes designing, detailing, furnishing, erecting, stripping forms both for unusual structures and standard construction.

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MEN AND JOBS

Promotions in rank of several members of the military personnel assigned to duty with the Engineering Section, Division of Health and Sanitation, Office of the Coordinator of Inter-American Affairs, have been announced. All of the officers named hold commissions in the Sanitary Corps of the Medical Department, and the titles given indicate their new rank. The list includes:

Maj. J. D. Caldwell, formerly director of public health engineering for Knoxville, Tenn., who has been stationed in the Republic of Panama since March 1943.

Maj. P. C. Karalekas, who has been directing the engineering work of the division of health and sanitation in Honduras. He was formerly with the Massachusetts department of health, and the repairs and utilities section of the U. S. Engineers.

Maj. A. J. Kranaskas, who has been in Bolivia since July 1942, much of the time in Guayaramerin on the Brazilian-Bolivian border. Before entering the Army he was a public health engineer with the West Virginia and Georgia state health departments.

Maj. L. A. Young, who entered the service in December 1942 from the Kansas state board of health, of which he was acting chief engineer and director. His headquarters have been in Bogota, Colombia, since that time.

Capt. J. B. Brown, who has been stationed in El Salvador and Honduras since entering the Sanitary Corps in January 1943. He was formerly a public health engineer in Texas, both with the state department of health and the U. S. Public Health Service.

Capt. S. S. Friedman, who was formerly employed as a civil engineer in New York City by the Boroughs of Queens and Brooklyn. He has been on field assignment with the Coordinator's office since November 1942, with his principal duty station at Belem, Brazil.

Capt. L. D. Hudson, who has been stationed in Colombia since March 1943. Prior to his assignment to the Division of Health and Sanitation he was a sanitary engineer with the Illinois state department of health.

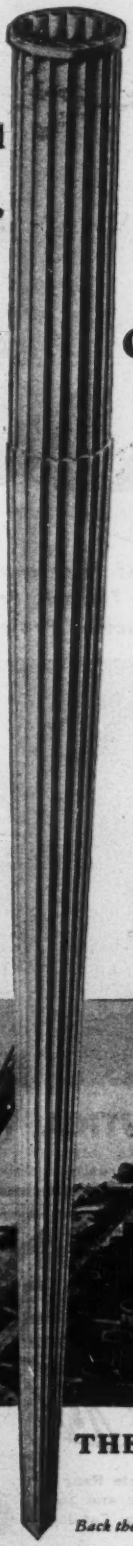
Capt. J. B. McLellan, who was a sanitary engineer with the Kentucky state health department prior to entering the service, and is now stationed in Peru. He has been working primarily in the Iquitos region of the upper Amazon River.

Capt. C. E. Richey, formerly a district engineer with the Iowa State Department of Health, who is now engaged in sanitary engineering with the Bolivia field

Job-experienced builders say:

"MONOTUBES'

Speedy Handling



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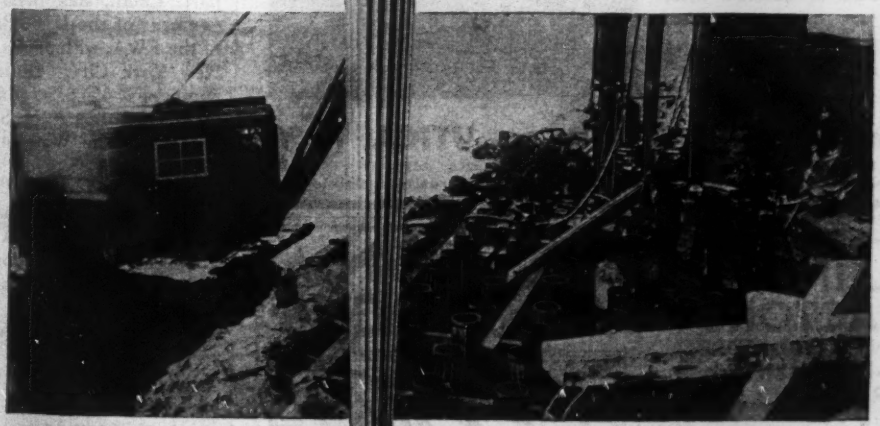
Other outstanding Monotube features are:

SPEEDY DRIVING—Monotubes are so strong and rigid they require no heavy core or mandrel and can be driven with average job equipment.

SPEEDY EXTENSION—The use of Extendible Monotubes permits installation of varying pile lengths (even in low headroom), without delay or waste.

SPEEDY INSPECTION—The hollow tubular design of Monotubes enables you to inspect the casings quickly and thoroughly from top to toe prior to concreting.

Monotubes are available in a wide range of gauges, sizes, and tapers to meet exacting requirements in varying soil conditions. Write for your copy of the Monotube Catalog 68A which gives additional valuable information.



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party of the Division of Health and San tation.

Capt. E. G. Wagner, who has bee working on the Amazon Project wi headquarters in Belem since Decembe 1942. He was initially employed as civilian but was commissioned a fir lieutenant in February, 1943. He worke extensively on construction work in Sout Dakota before going into public healt work in 1941, when he joined the sta of the Minnesota state department health.

Lt. J. D. Williams, who was a sanitar engineer with the Illinois department public health before joining the staff the Coordinator's office in January, 194 He has since been stationed in Brazil, fir at Belem and later at Porto Velho, on th Amazon.

Roy W. Thompson, Windsor, Conn has been appointed director of the Con necticut Bureau of Highway Boundarie and Rights of Way, as the result of com petitive examinations under the state merit system. Mr. Thompson has serve as assistant to the director and succeed Charles F. Taylor, who was named exec utive deputy commissioner.

Col. McDonald D. Weinert, distric army engineer at San Antonio, Tex., ha been appointed district engineer at Mil waukee, Wis. He succeeds Col. H. Woodbury, who has been transferred t Chicago, Ill.

Charles M. Brogan, project enginee for the Federal Works Agency at Bridg port, Conn., has been appointed chie engineer of the U. S. Properties Divisio of the FWA, with offices at 101 Park Ave New York City. Duties of the projec engineer's office at Bridgeport will b taken care of by A. M. Sjoball, district en gineer for the Waterbury and Hartfor areas.

John S. Bennett has been commi sioned a major in the Army and will tak a special indoctrination course at Fo Custer, Mich., after which he will be a signed overseas duty with the Publi Works Division of the Army in conquere territories. He went to the University North Carolina, in 1921, as chief of uti ities, rose to supervisor of operations an has been granted a leave of absence fro the university for military service.

Lt. Robert Boyce, Civil Engineerin Corps, U.S.N.R., of Holdredge, Neb., ha completed the C.E.C. post gradua course at Norfolk Naval operating ba and has been assigned to new constru tion projects at the Fourth Naval Distri

CONCRETE PAVING IN COLD WEATHER

proved feasible on large scale war projects

LARGE scale concrete paving projects completed by the U. S. Engineer Department during the severe winter of 1942-43 proved the soundness of cold weather concrete construction methods in temperatures as low as 20 degrees above zero.

Methods successfully applied on many of these urgent military projects included the following steps:

Preparation, treatment and protection of subgrade to prevent freezing.

Production and delivery of warm concrete with ample allowance for heat losses during placing and finishing.

Placing and finishing slab with minimum loss of heat from the concrete before cover is applied.

Protection of slab to maintain satisfactory curing temperature.

Experience of government engineers in placing millions of square yards of concrete pavement on some of the largest military projects during cold weather has been compiled to assist military and civilian engineers and contractors in expediting winter concrete paving. Revised edition of "Construction of Concrete Pavement in Cold Weather" contains illustrations and details of latest cold weather technique. Copies are available free in the United States and Canada.

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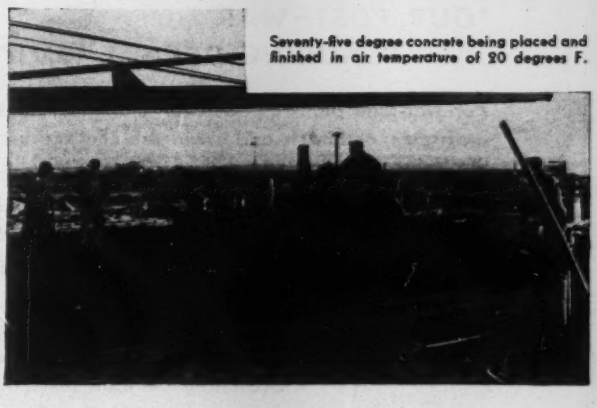
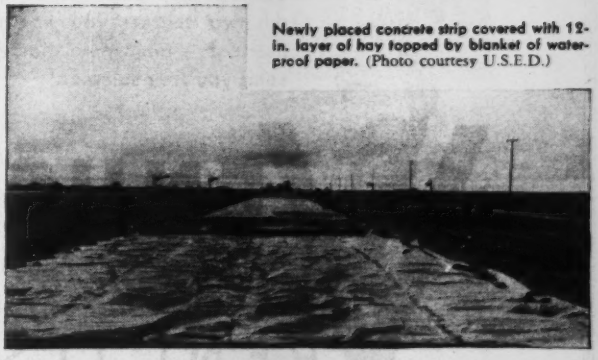
A national organization to improve and extend the uses of concrete ... through scientific research and engineering field work

★ **BUY MORE WAR BONDS** ★

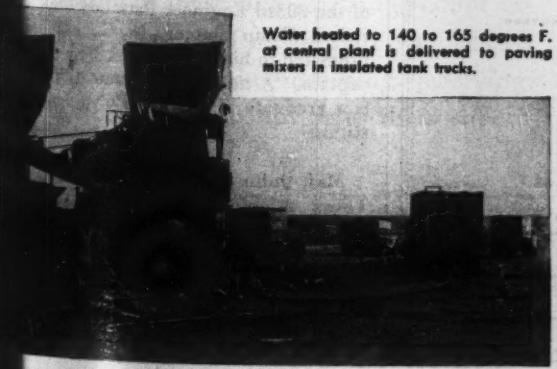
After rough grading, subgrade is protected from freezing by 12-in. layer of loose hay or straw. (Photo courtesy U.S.E.D.)



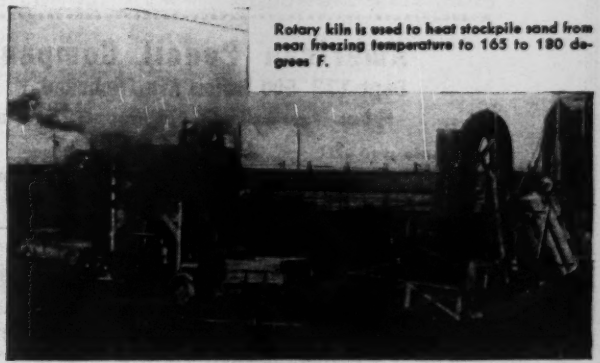
Seventy-five degree concrete being placed and finished in air temperature of 20 degrees F.



Newly placed concrete strip covered with 12-in. layer of hay topped by blanket of waterproof paper. (Photo courtesy U.S.E.D.)



Water heated to 140 to 165 degrees F. at central plant is delivered to paving mixers in insulated tank trucks.



Rotary kiln is used to heat stockpile sand from near freezing temperature to 165 to 180 degrees F.

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Philadelphia, Pa. Lt. Boyce was formerly senior engineer with the U. S. Engineers, Missouri River Division, and resident engineer for Central Nebraska Public Power and Irrigation District. **Lt. R. A. House,** formerly district engineer with the Nebraska department of roads and irrigation, Lincoln, Neb., has completed training at Camp Peary, Va., and has been assigned to a Seabees battalion.

P. N. Gross has been appointed vice-president and general manager of Anglin-Norcross Ltd., general contractors, Montreal, Que.

Ray E. Behrens, a graduate of the University of Wisconsin and for the past 20 years principal assistant civil engineer for Milwaukee County, Wis., regional planning department, has been commissioned a captain in the provost marshall general division.

The appointment of **F. S. Hill** assistant district engineer of maintenance in the La Porte, Ind., district for the past several years, as field engineer of maintenance at Anderson, Ind., has been announced.

Charles B. Whitnall, 84-year old "grand old man" of park planning in Milwaukee, Wis., has resigned due, he says, to the lack of time for actual planning because of so much routine matter in his department.

Thomas L. Briggs, Jr., of Raleigh, N. C., recent graduate of the North Carolina State College Engineering School, has been commissioned an ensign in the U. S. Naval Reserve and has reported for duty at the Navy's Engineering School at Cornell University.

Col. F. F. Clarke is retiring from the post of chief land surveyor and property commissioner of the Canadian National Railways after having served the railway for 37 years. He is a civil engineering graduate of the University of Toronto and in the first World War was decorated for bravery.

Maj. Moe I. Becker, executive officer of the 303rd Engineer Battalion, 78th Division, Camp Butner, N. C., has been promoted to his present rank from that of captain. A native of Richmond, Va., he is a graduate of Virginia Polytechnic Institute.

Maj. John J. Closner, a graduate of Texas A. and M. College, has been named commanding officer of the 303rd Engineer Battalion, 78th Division, at Camp Butner, N. C. He succeeds Maj. Charles A. Grennan. A civil engineer prior to entering active duty with the Army in 1941, Major Closner served as

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●Continuous, smooth operation of shovels and mucking machines depends to a large extent on the way your material is broken.

Hercomites* and Gelamites* lay down the rock and ore for easy, speedy handling—hold idle machine hours to a minimum.

More of these high-cartridge-count explosives are used today than ever before, because throughout the mining, quarrying, and construction industries their superiority has been definitely established. They are more economical and more effective. Six grades of Hercomite* and two of Gelamite* meet your requirements for nearly all types of blasting.

Thus, to get the maximum production from your present equipment . . . and hold powder costs to a minimum at the same time, investigate Hercomites* (2 to 7) and Gelamites* (1 and 2).

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A big mouthful with every bite
In dirt, clay, coal, gravel or ore you can rely on one of the tough, properly designed, Brownhoist buckets to take a full load with every bite. Extra large sheaves reduce rope wear to a minimum. Brownhoist Buckets are available in rope-reeve, power-wheel and link type. For prices and further facts write INDUSTRIAL BROWNHOIST CORPORATION, Bay City, Michigan. Offices in New York, Philadelphia, Pittsburgh, Cleveland and Chicago.
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GIVE MORE YEARS OF
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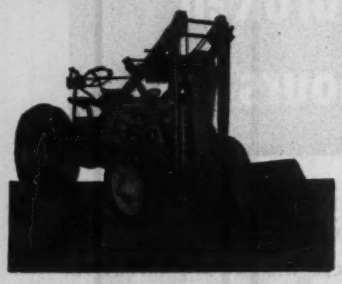

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Extensible Booms—8' Lift
½ and ⅝ cu.yd. Capacity

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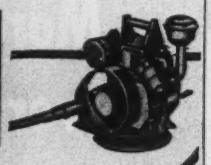

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Three types: *Vibrating screed*, full-width, propelled by hand-operated winch and cable or pushed ahead by finishing machine. Gasoline power plant.
Tubular internal, extending entirely across slab, mounted in front of finisher. Gasoline or electric power plant with flexible shaft drive.
Vibrating pan, full-width, carried by two-wheeled trailer behind any standard finisher. Gasoline or electric power plant.

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1, 3, and 4 H.P. gasoline, air-cooled, 4 cycle motors; flexible-shaft drive; interchangeable vibrator heads lubricated for life. Wheelbarrow carriers.

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commanding officer of the 294th Combat Engineer Battalion at Camp Gordon, Ga., before being assigned to Camp Butner.

Capt. Thomas A. Cantrell, of the Army Corps of Engineers, has assumed duties as area engineer at the Ozark ordnance works near El Dorado, Ark., succeeding Maj. William C. Campbell. Captain Cantrell who also is area engineer for the Dixie Ordnance Works near Monroe, La., will continue to live at Monroe and divide his time between the two plants.

Paul M. Van Camp, of Southern Pines, N. C., is the consulting engineer in charge of plans and specifications for the construction of additional sewerage facilities to serve a federal housing project at Aberdeen, N. C.

S. B. Stuck, of Bloomfield, Ia., has resigned as county engineer of Davis County, Ia., to live on his farm near Mount Ayr. Herbert Hill, who has been assistant county engineer since 1931, succeeds him.

George W. Kane, of Roxboro, N. C., construction contractor and member of the North Carolina Highway and Public Works Commission, on Sept. 29 was appointed to represent the highway commission on a nine-member state planning board just set up to consider postwar plans. The appointment was made by Governor J. M. Broughton, who has just created the board in accordance with an act of the 1943 North Carolina legislature. The board will cooperate with various municipal postwar planning boards which have been set up by a number of cities in the state.

Capt. Noble A. Bosley has been advanced to the position of executive officer, Seattle engineering district, U. S. Army, assuming the position held by Col. H. J. Wild, who reached the retirement age recently. He previously served as assistant chief of the construction division of the Seattle district.

Roy A. Welsh, city engineer of Centralia, Wash., for eight years, has resigned to asusme a similar position with the city of Ephrata, Wash.

Capt. Martin J. Damgaard, of Superior, Wis., plans and training officer of the 602nd Engineer Camouflage Battalion at Camp Butner, N. C., has been promoted to his present rank from that of first lieutenant.

William Cooper, formerly area engineer in Pueblo, Colo., and more recently at the Modification Center project in Denver County, has been named assistant to Capt. Raymond T. West, area engineer

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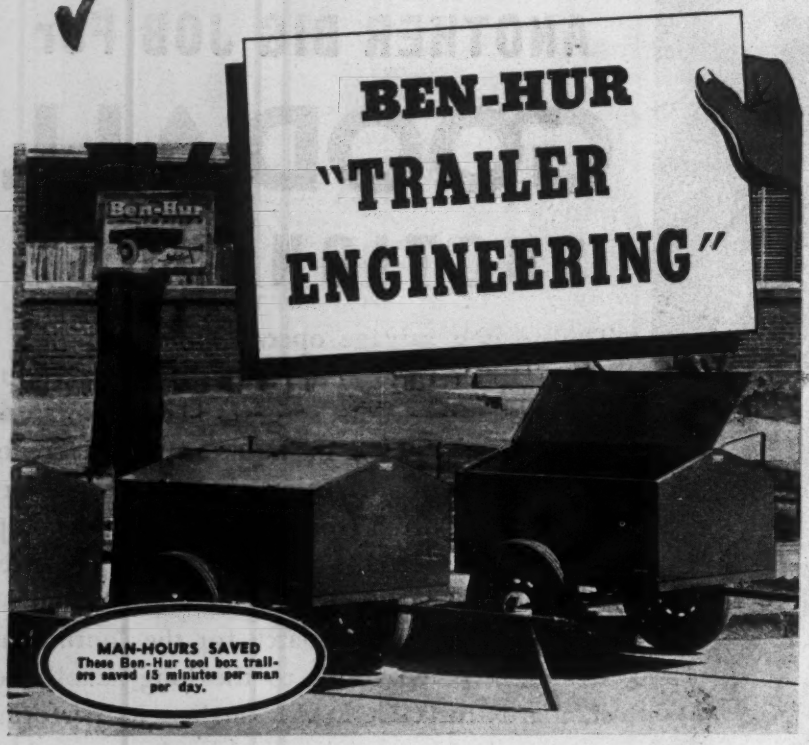

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in charge of construction of the War Pri oners Camp in Weld County, Colo.

Lt. Col. Charles W. Walker, for th past 18 months commanding officer of th Maumelle Ordnance Works, Maumell Ark., has taken command of the Redfor Ordnance Works and the New River Ord nance Plant at Radford, Va. Succeedin Colonel Walker will be **Maj. Edgar A Haine,** Lake Ontario Ordnance Work Model City, N. Y. Before assuming com mand at Maumelle, Col. Walker served i Washington, D. C., and Aberdeen, Md.

Col. Jarvis J. Bain, district enginee of the Memphis District, U. S. Engineers has been retired. Lieut. Col. Garner W Miller, chief of the operations division has been appointed district engineer Colonel Bain has been retired unde Army age regulations. He was the builde of the first American fortifications on Cor regidor.

The advancement to other posts of sev eral engineers of the North Carolin Highway and Public Works Commissio has been announced. **J. W. Jenkins** formerly stationed at Graham, N. C., a engineer in charge of the second distric of the Fifth Highway Division with super vision of highways in Alamance, Caswel and Orange counties, has been trans ferred to Greensboro, N. C., as assistan division engineer. He succeeds C. O **Lowe,** who resigned to become connecte with the Southern Mapping & Engineer ing Co. at Greensboro. Succeeding Jen kins at Graham as second district engi neer is **L. H. Gunter,** who for the pas five years has been attached to the divi sion engineer's office at Greensboro a maintenance supervisor for highways i Guilford County. Succeeding Gunter a maintenance supervisor for Guilford County is **Roy S. Thomas,** who has bee connected with the highway maintenanc department of the Sixth Division, wit headquarters at Lexington, N. C.

Stanley G. Reis, head of the materials section of the U. S. Engineering Division

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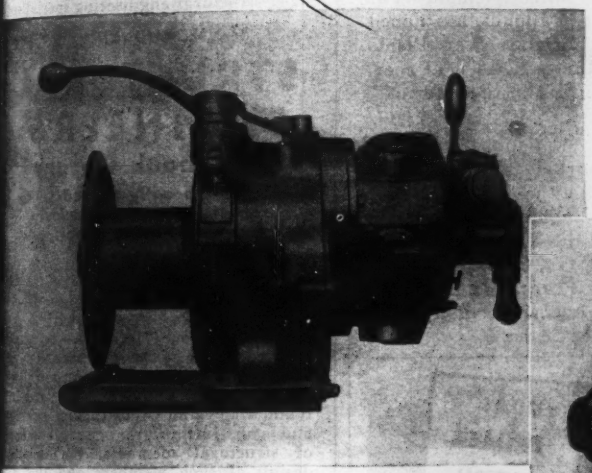

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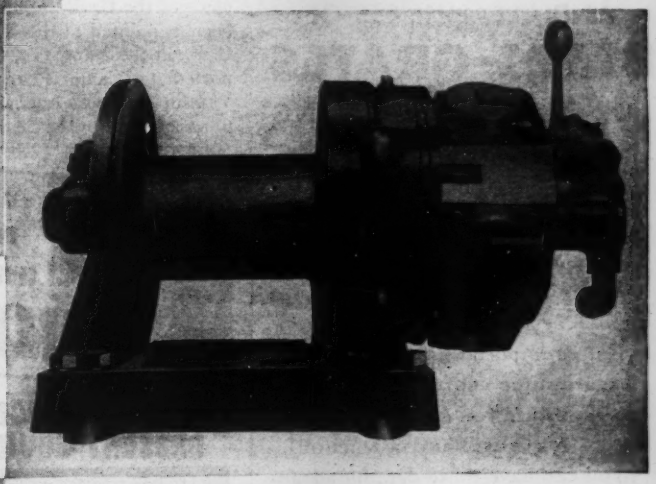
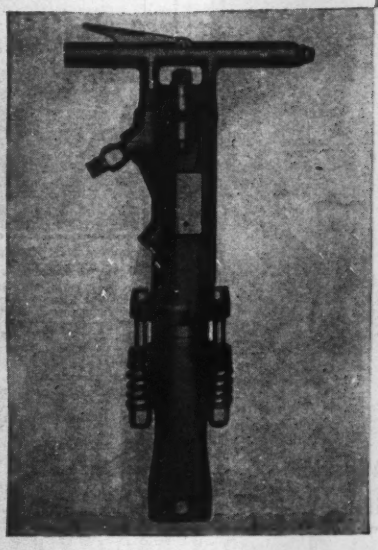


2. FOR LIFTING ONE-TON LOADS—A larger, more powerful hoist, the Gardner-Denver Model HK Single Drum Hoist is powered by a larger size five-cylinder air motor. The HK easily handles a 2,000-pound vertical lift at 130 feet per minute. Available also with long drum for added rope capacity.



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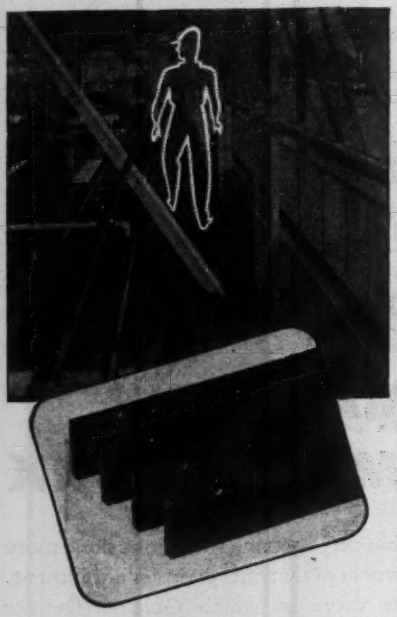

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at Omaha, Neb., has been promoted to the rank of major.

C. C. Owens, formerly division engineer for the Missouri state highway department in Division 8, Springfield, is now engineer of special assignments with headquarters in Jefferson City.

Capt. M. C. Ohlson, succeeds Capt. William M. Berry as assistant engineer, Seventh Service Command, in Omaha, Neb.

Roy L. Clark, Des Moines, Iowa, of the consulting engineer firm of Nemmers & Clark, has joined the War Production Board's Iowa staff.

Harry L. Smith, formerly employed at an ordnance plant in Illinois, has joined the staff of the Smaller War Plants Corporation in Minnesota as field coordinator of the U. S. Maritime Commission.

Edward S. Pomykala, formerly associate engineer with the Mobile district office of the U. S. Engineers, has recently been appointed to the rank of lieutenant, C. E., in the Navy. Lt. Pomykala has reported to Camp Peary, Williamsburg, Va., for six weeks intensive training prior to assignment to the Seabees.

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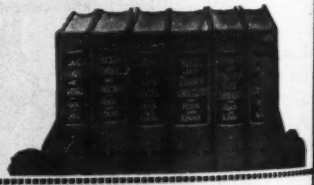

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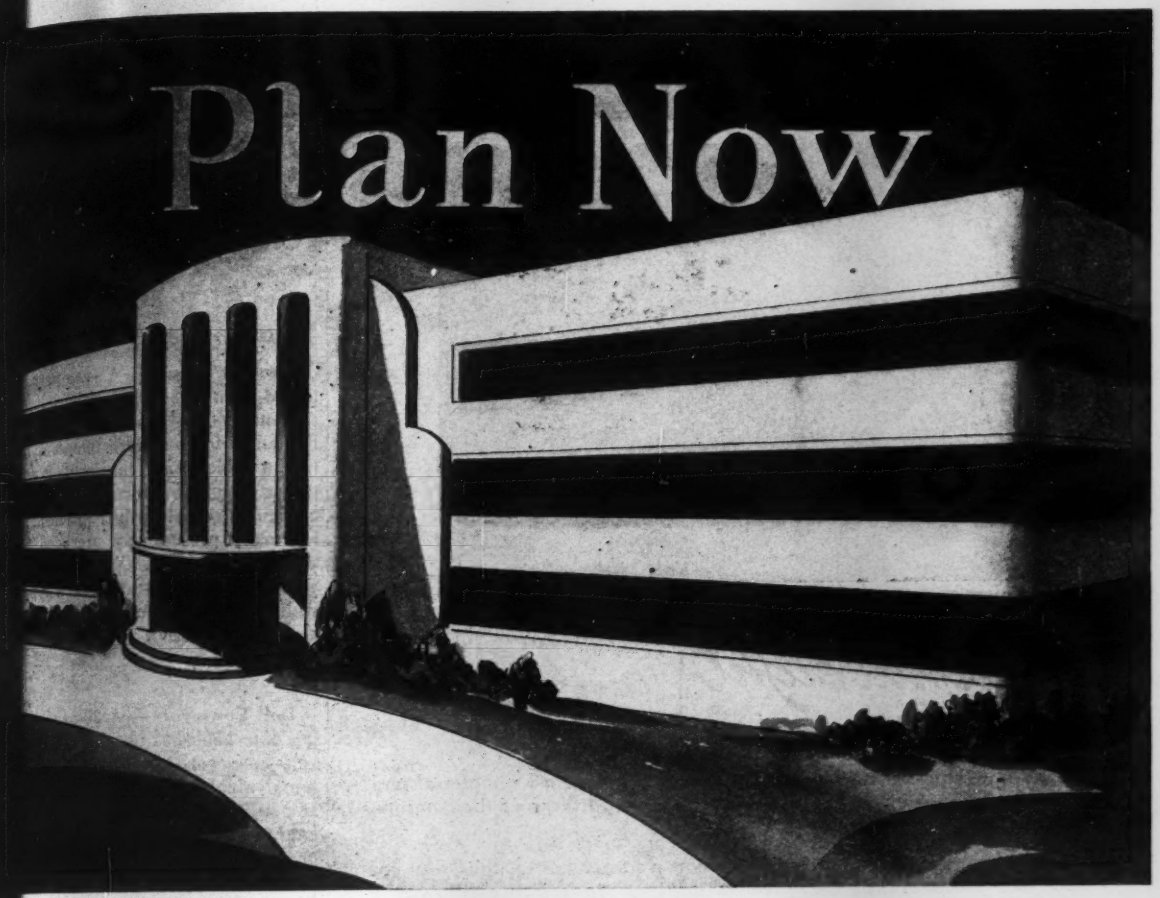

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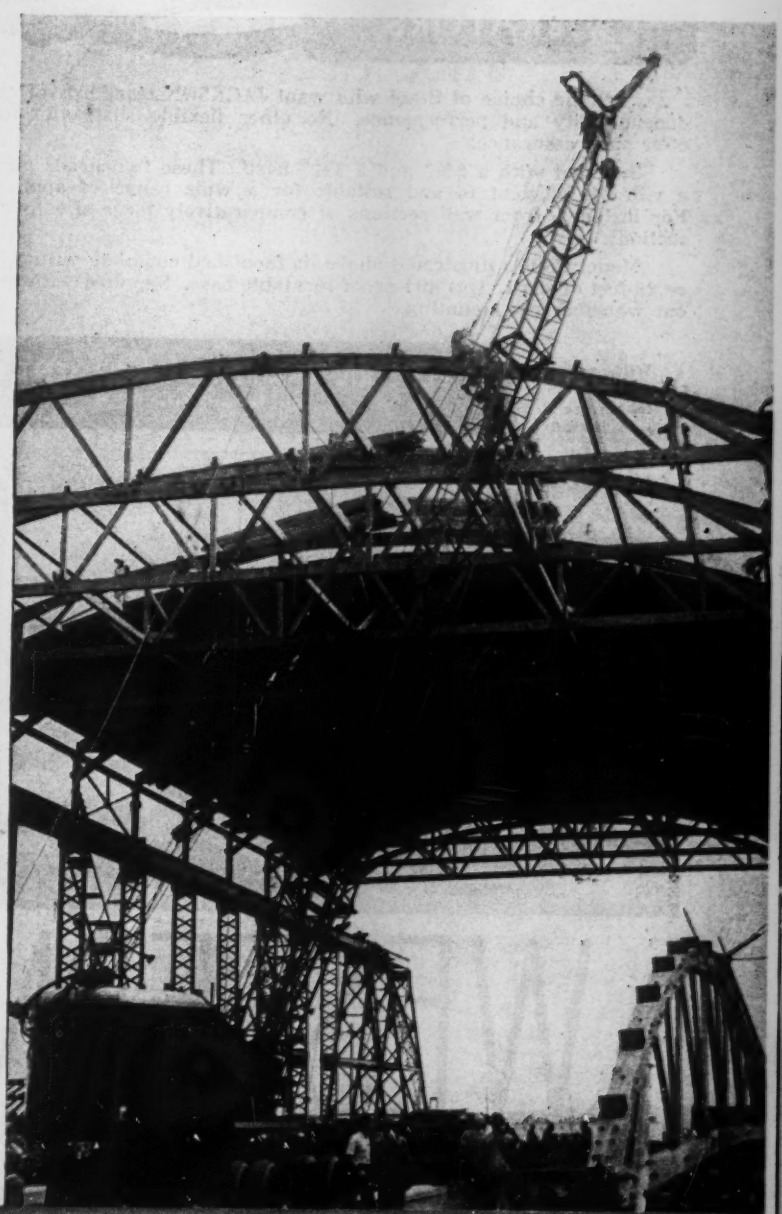

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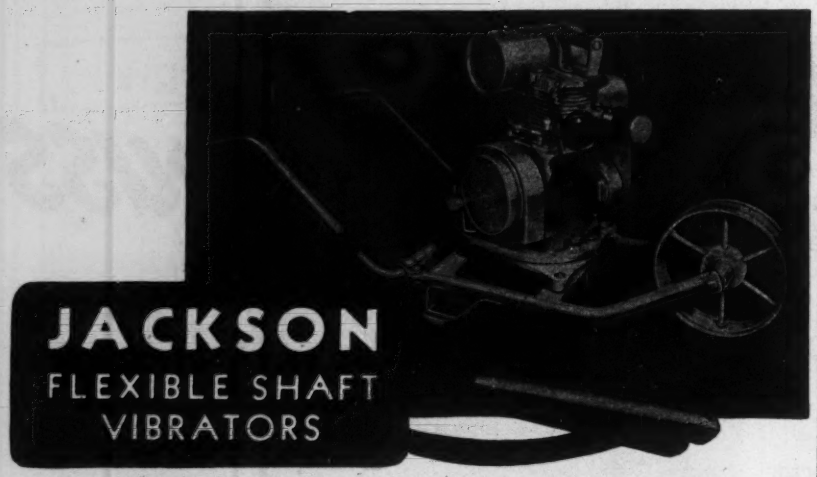

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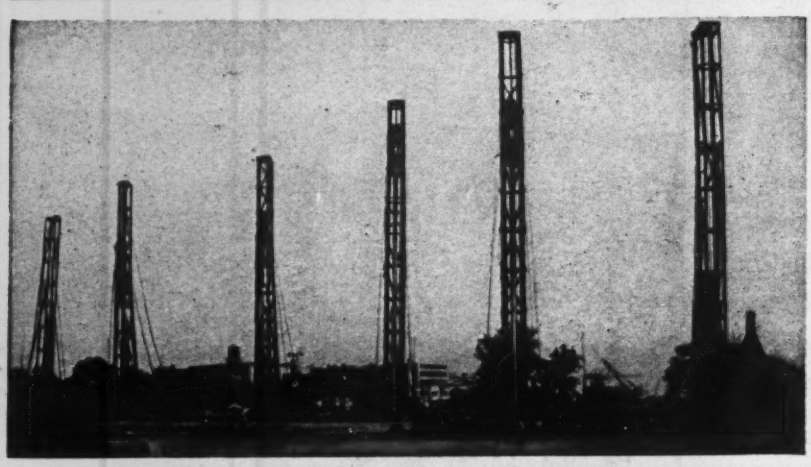

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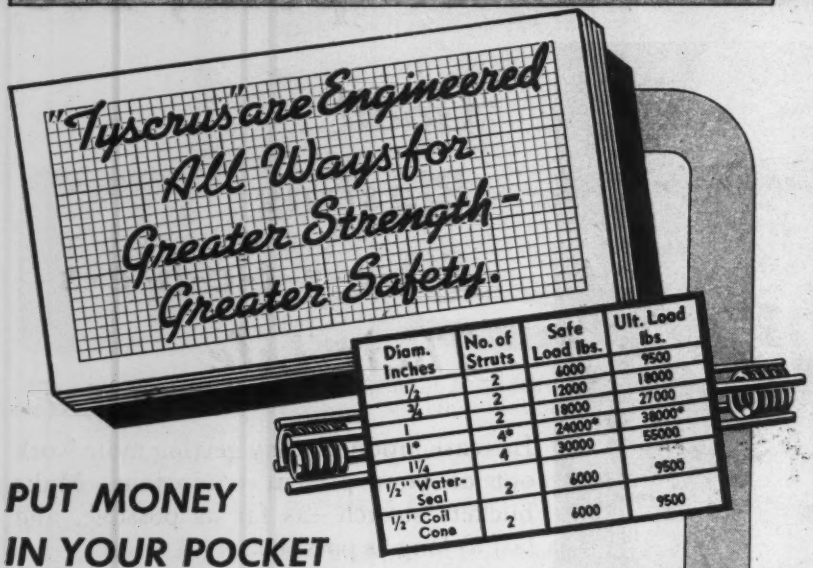

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be assembled with simple wrenches. It is suitable for many purposes, including cabinets, machine housings, refrigerator units, processing rooms, industrial buildings, truck and trailer bodies, and other structures.—*Lindsay and Lindsay, 222 W. Adams St., Chicago 6, Ill.*

Paint Spraying Rules—A wall chart of paint spraying rules showing how to save paint, air, time, power, fuel, and equipment, reduce time lost because of sickness or accident, and improve results, has been published. These rules apply to all types of spray equipment.—*Eclipse Air Brush Co., Inc., 390 Park Ave., Newark, N. J.*

Porcelain Enameled Iron—Useful data for product engineers, designers, architects and others interested in the use of porcelain enameled iron are presented in this booklet, "Porcelain Enamel, the Lifetime Finish." Engineering information is given on abrasion and friction resistance, weather resistance, resistance to chipping, resistance to thermal shock, color fastness and range of finishes available, chemical resistance and physical properties of porcelain enamel. Its physical properties also are compared with those of many other materials: glass, ceramic white ware, thermo-setting plastics, hard rubber, aluminum and its alloys, nickel, copper, zinc, iron alloys and cast iron.—*The American Rolling Mill Company, Middletown, Ohio.*

Engineering Manual—An unusual combination of catalog and engineering manual has been prepared by this manufacturer. It is a comprehensive listing of flexible couplings and fittings for use with grooved pipe, as well as a guide to their use in industrial, mining, petroleum, shipbuilding and water works and sewerage fields. The engineering and catalog material have been tabulated by industries to facilitate its quick and easy use.—*Victaulic Company of America, 30 Rockefeller Plaza, New York, N. Y.*

MEETINGS

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT, 11th annual meeting, American Society of Civil Engineers, 33 West 39th St., New York, N. Y., Oct. 23.

FEDERATION OF SEWAGE WORKS ASSOCIATIONS, Hotel Sherman, Chicago, Ill., Oct. 21-23.

PUBLIC WORKS CONGRESS, Hotel Sherman, Chicago, Ill., Oct. 24-27.

NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS, annual meet

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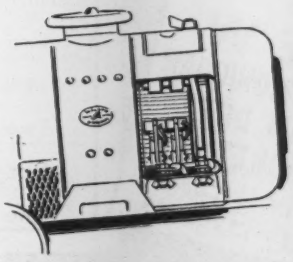
1. Keep every welding machine protected when it's not in use. Don't, however, cover the machine when running—it needs ventilation.

2. Don't overload your machine. For instance, do not use the machine continuously above its rated capacity. This causes overheating and charred insulation.

3. Be sure that bearings are properly greased. Refer to manufacturer's operating instructions for correct procedure and recommended lubricants.

4. Check all connections regularly to insure perfect contact. Loose connections may cause erratic operation.



5. Check brushes of D. C. machines periodically to be sure they make proper contact with the commutator.

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One	2¼ cu. yds.	4,000 lbs.
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AMERICAN STEEL DREDGE CO., INC.
Fort Wayne, Ind.
Write for Bulletin RD-102

ing, Lincoln Hotel, Indianapolis, I Oct. 25-26.

AMERICAN PUBLIC WORKS ASSOCIATI Hotel Sherman, Chicago, Ill., Oct. 24, 26 and 27.

NATIONAL RECLAMATION ASSOCIATI Denver, Colo., Oct. 27-29.

ASSOCIATED GENERAL CONTRACTORS AMERICA, INC., Drake Hotel, Chica Ill., Nov. 1-2.

INDUSTRIAL HYGIENE FOUNDATION, annual meeting, Mellon Institute, Pi burgh, Pa., Nov. 10-11.

THE PRODUCERS' COUNCIL, INC., 2 semi-annual meeting, Hotel Biltm New York, N. Y., Nov. 10-11.

HIGHWAY RESEARCH BOARD, 23rd ann meeting, Edgewater Beach Hotel, C cago, Ill., Nov. 27-30.

AMERICAN ASSOCIATION OF STATE HI WAY OFFICIALS, annual meeting, Chica Ill., Dec. 1-3.

JOINT MEETING, Society for Experimen Stress Analysis with Applied Mechani Division, American Society of Mechani Engineers, Hotel Pennsylvania, N York, N. Y., Dec. 2-4.

CALIFORNIA SECTION, AMERICAN WA WORKS ASSOCIATION, Biltmore Hotel, L Angeles, Calif., Oct. 27-29.

CANADIAN INSTITUTE ON SEWAGE A SANITATION, annual convention, Gene Brock Hotel, Niagara Falls, Ont., O 28-29.

TEXAS SECTION, AMERICAN SOCIETY CIVIL ENGINEERS, fall meeting, Dris Hotel, Austin, Texas, Oct. 28-29.

ENGINEERS' SOCIETY OF WESTERN PE SYLVANIA, fourth annual water conf ence, William Penn Hotel, Pittsbur Pa., Nov. 1-2.

NORTH CAROLINA SECTION, AMERIC WATER WORKS ASSOCIATION, AND NOR CAROLINA SEWAGE ASSOCIATION, wartim conference, Hotel Robert E. L Winston-Salem, N. C., Nov. 1-3.

NEW JERSEY SECTION, AMERICAN WA WORKS ASSOCIATION, fall meeting, Ho Madison, Atlantic City, N. J., Nov. 4-6.

ASSOCIATED GENERAL CONTRACTORS Massachusetts, Hotel Statler, Bost Mass., Nov. 8.

CAROLILNAS BRANCH, ASSOCIATED G ERAL CONTRACTORS, Pinehurst, N. Dec. 6-7.

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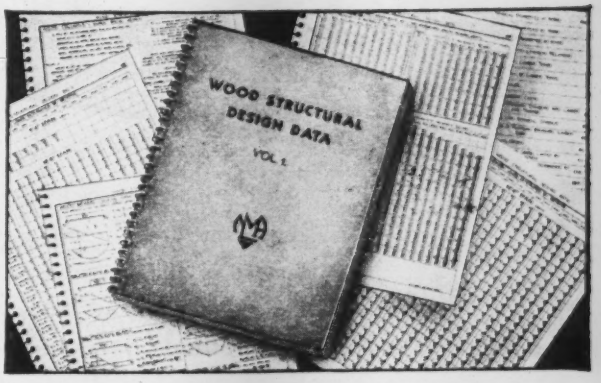
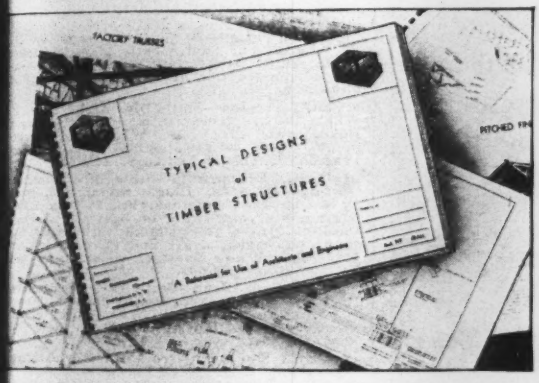


DESIGN DATA SERVICE. Teco has available for architects and engineers complete data on all phases of timber design, including tables and charts on timber beams, columns, floors, connector loads, bolt loads, stresses, etc.



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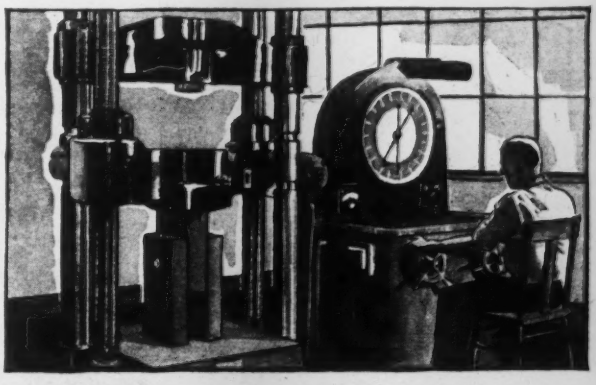

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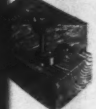

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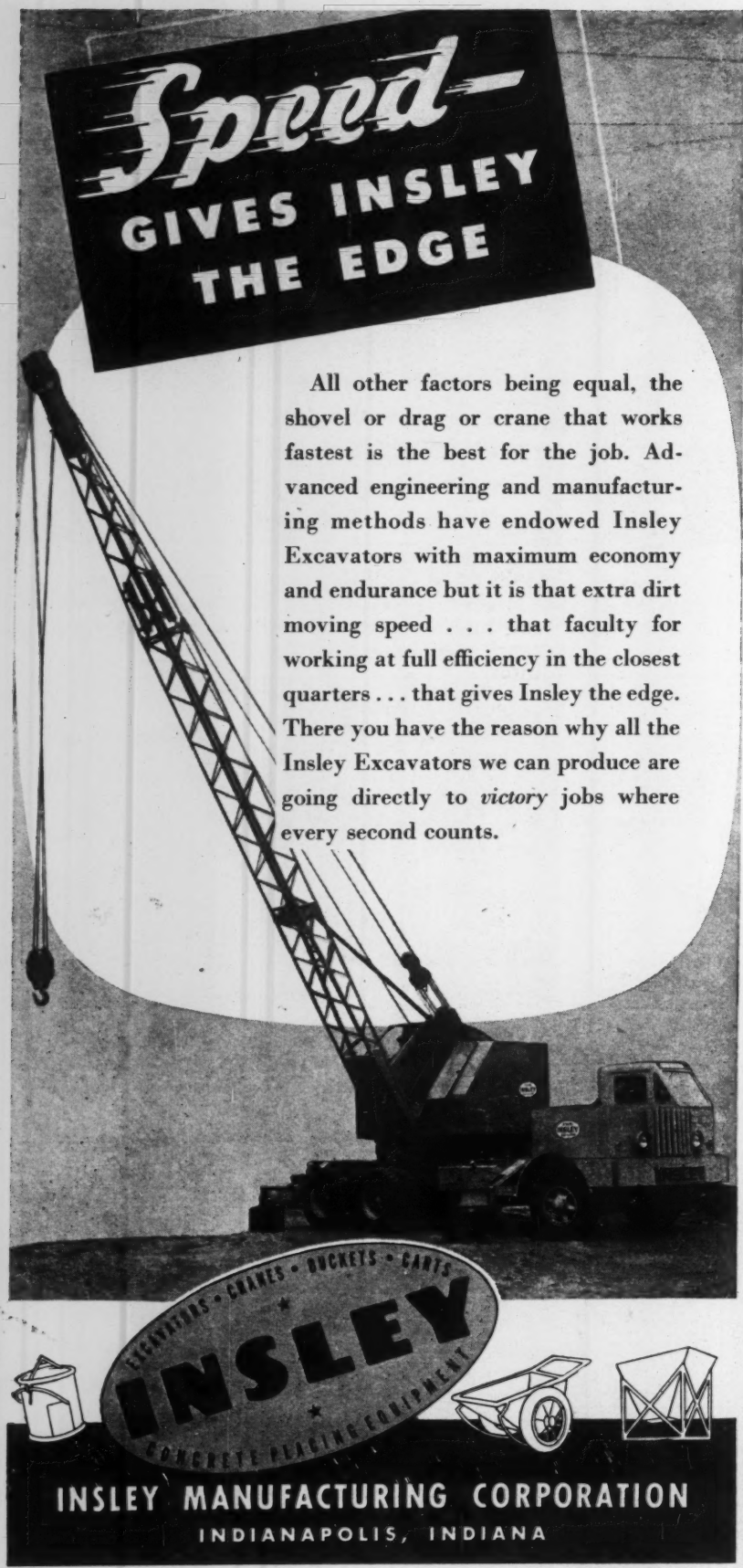
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PUBLIC BUILDINGS

California—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, diagnostic, classification and detention unit in Southern California, $300,000.

Calif., Agnews—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, Agnews State Hospital, $137,000.

★**Calif., Camarillo**—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, construction at Camarillo State Hospital, $1,550,000.

Calif., Chico—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, training school, at Chico State College, etc. $284,000.

★**Calif., Eldridge**—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, 5 new wards at Sonoma State Home, $686,000.

Calif., Folsom City—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, reconstructing kitchen, dining room and bakery facilities at Folsom State Prison, $200,000.

Calif., Fresno—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, remodeling lighting sys. of Fresno State College, $29,000.

Calif., Humboldt—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, industrial arts bldg. at Humboldt State College, $95,000.

★**Calif., Imola**—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., new bldgs., incl. receiving and treatment unit, at Napa State Hospital, $1,140,000.

Calif., Norwalk—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd., state archt., P. Wks. Bldg., Sacramento, construction at Norwalk State Hospital, $110,000.

★**Calif., Patton**—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, construction at Patton State Hospital, $1,045,000.

Calif., Preston—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, new administration bldg., etc. at Preston School of Industry, $221,000.

★**Calif., Sacramento**—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, new wing on east side of State Capitol, 3 to 5 stories high with bsmt. garage, $1,500,000; draft and show horse barn $127,000, and new livestock coliseum, $530,000, both at Fair Grounds.

Calif., San Diego—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, construction at San Diego State College, $83,000.

★**Calif., San Francisco**—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, construction at San Francisco State College, $2,282,000.

★**Calif., San Jose**—City, City Hall, plans City Hall. $500,000. H. J. Flannery, city engr.

Calif., Spadra—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, Pacific Colony, $400,000.

★**Calif., Stockton**—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, ward bldg. at Stockton State Hospital, etc., $710,000.

Calif., Talmadge—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, new criminal insane ward for men at Mendocino State Hospital, $450,000.

Calif., Ventura—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, construction at Ventura School for Girls, $394,000.

Calif., Whittier—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, construction at Whittier School for Boys, $165,000.

★**Calif., Yountville**—State Div. Architecture, P. Wks. Bldg., Sacramento, plans by Anson Boyd, state archt., P. Wks. Bldg., Sacramento, new convalescent unit $280,000, new hospital wing $180,000, and new administration bldg. $125,000, at Veterans Home.

Conn., Bristol—A. C. Fink, chn., City Hall Com., City Hall, municipal bldg. Over $150,000.

Conn., Canaan—Robert C. Geer Memorial Hospital, South Canaan, plans by McClintock & Craig, 458 Bridge St., Springfield, Mass. 1 story, brick, steel hospital addn.

POSTWAR PROJECTS (Cont'd.)

★**Ill., Decatur**—Bd. Educ., Decatur, school building program. To exceed $500,000.

★**Ia., Sioux City**—D. A. Anderson, acting mayor, completing municipal auditorium $400,000; city hall $200,000.

Me., Presque Isle—M. Trafton, city mgr., municipal bldg. to house city management personnel and central fire station. $150,000.

Mass., Fitchburg—Supt. P. Bldgs., City Hall, infirmary, $160,000.

Mass., Milton—Town Bd. Selectmen, Town Hall, brick, steel municipal hospital. $150,000.

Mass., Worcester—Pub. Bldgs. Dpt., City Hall, brick, steel high school, Chandler and May Sts. Over $150,000.

Mass., Worcester—City Fire Dpt., 3 Mercantile St., modernizing 17 fire stations, addns. $385,000.

O., Cuyahoga Falls—City, A. B. Crafton, dir. Public Serv., City Hall, city hall.

★**R. I., Howard**—State Dpt. Social Welfare, 40 Fountain St., Providence, pathology unit $150,000, tuberculosis bldg. $200,000; brick, steel male patients hospital unit $300,000; female patients hospital unit $300,000; completely remodeling Bldg. H $200,000; brick, convalescent bldg. $250,000; elderly men hospital unit $250,000; gymnasium and swimming pool $175,000; warehouse $55,000, all at State Hospital for Mental Diseases.

★**Texas**—State Bd. Control, Austin, new bldgs., facilities for State Medical Hospital Institutions at designated locations throughout state. Approx. $3,000,000.

★**Tex., Austin**—State Bd. Control, state office and stores bldg. $2,000,000. CD 10/23/42—ENR 10/29/42.

Tex., Dallas—Dallas Co., Courthouse, new courthouse bldg.

★**Va., Richmond**—City Council, municipal bldg., $2,550,000; gas plant imprvs., $2,146,000.

Alta., Calgary—City Comrs., J. R. Wood, engr., auditorium and arena, $450,000.

★**Man., St. Boniface**—E. A. Poulin, city clk., low priced dwellings, $500,000. J. A. Bibeau, City Hall, engr.

★**Man., Winnipeg**—G. Coulter, mayor, new schools, repairing schools. $1,000,000. W. P. Brereton, City Hall, engr.

N. B., Edmundston—Provincial Govt., Fredericton, agricultural school. $150,000.

N. B., Grand Falls—M. McCluskey, mayor, vocational school and municipal bldg. $200,000. T. A. McCann, Town Hall, engr.

N. B., St. Stephan—Municipality, vocational training school, remodeling town hall. $200,000. W. H. Johnson, Town Hall, engr.

N. B., Victoria—Provincial Govt., Fredericton, vocational school and sanatorium for tuberculosis patients, $350,000.

N. B., Woodstock—E. A. Neal, mayor, Fisher Memorial Hospital, $150,000.

N. S., Sydney—City, L. M. Urquhart, mayor, housing, new city hall, technical school bldg., new school bldgs.

★**Ont., Forest Hill**—Village, F. G. Gardiner, reeve, 333 Lonsdale Ave., plans municipal building and library, preparatory and high school extens. $600,000.

★**Que., Quebec City**—F. X. Chouinard, city clk., exten. City Hall and fireproofing existing bldg. $750,000. E. Hamel, City Hall, engr.

Que., St. Hyacinthe—Municipality, Hon. T. D. Bouchard, mayor, school and police station, $155,000. L. Crepeau, City Hall, engr.

Sask., Saskatoon—Municipality, c/o S. N. MacEachern, mayor, city hall, $250,000. G. D. Archibald, City Hall, engr.

COMMERCIAL BUILDINGS

★**Fla., Miami**—Morris Bros. Co., Miami Beach, Zone 39, 5 story bldg., along west side E. First Ave. between Flager and S.E. First St. Approx. $1,000,000.

Minn., Northfield—St. Olaf College, C. M. Granskou, pres., plans by Land & Raugland, 540 Wesley Temple Bldg., Minneapolis, 2 story, 90x10 ft. boys' dormitory, utilities. To exceed $150,000 (unofficial).

★**O., Cleveland**—A. E. Arnoff, 4156 Hadleigh Rd., 3 story, brick, apartment. $750,000.

Tex., Brownsville—Trinity Lutheran Church, Brownsville, church, facilities. $150,000.

INDUSTRIAL BUILDINGS

Alta., Edmonton — PLANT — Co-Operative Soc. Ltd., H. G. Soucy, secy., cold storage plant and abattoir, canning factory and creamery, $140,000.

N. B., Edmundston—PLANT—Fraser Co., Ltd., plant exten. $100,000. F. O. White, c/o owner, engr.

Ont., Welland—MILL—Page Hersey Tubes, Ltd., 100 Church St., Toronto, electric weld mill. Approx. $50,000. Margison & Babcock, 210 Dundas St. W., Toronto, engrs.

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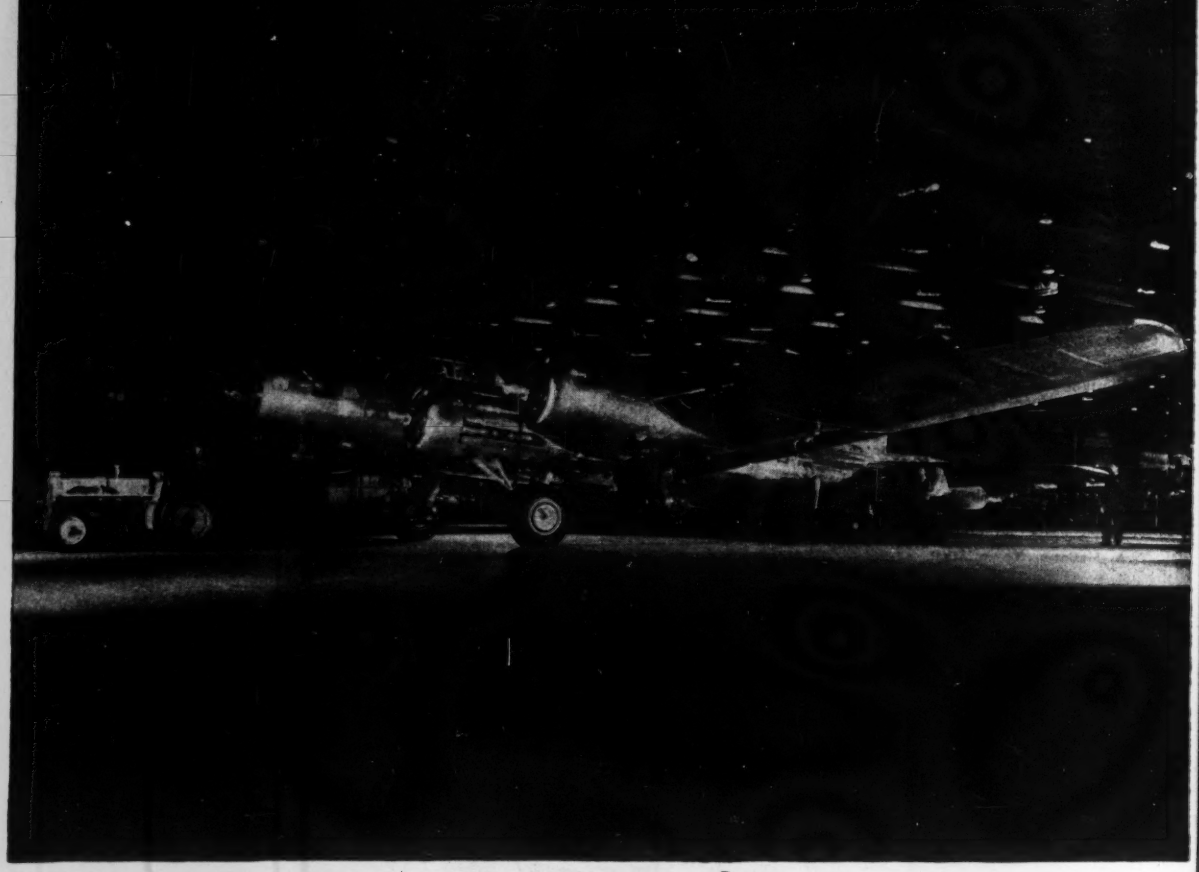

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WATER SUPPLY

POSED WORK

Ky., Louisville—Louisville Water Co., 435 S. 7 St., installing new coagulation basins, ...ning processes and misc. imprvs. $669,000.

..., Duck Hill—Town, City Hall, exten. ...r treatment plant and distr. sys. **$15,250.**

...sylvania—U. S. Eng., 6 and Walnut Sts., ..., wells. Contr. 36-109-eng-134, Phila Co., ...ughes-Foulkrod Co., Frankford Arsenal, ... $50,000.

..., Fort Worth—S. H. Bothwell, city mgr., ... Hall pump. facilities for Holley Water ... $125,632. Applied for FWA funds. ... & Nichols, Capps Bldg., engrs. CD 8/24 ...R 8/26 under BA.

..., Houston—Federal Works Agency, ... City Hall Annex, bids soon, drilling, cas- ... completely developing new water supply ... at San Jacinto River Pumping Plant. ... $18,000. W. H. McInturff, 704 City Hall ..., engr. CD 9/15—ENR 9/23.

..., Houston—Federal Works Agency, 704 ... Hall, cyclone and wire fencing for WW ...ing plant area. $25,000.

...D ASKED

Bids Asked October 29

..., Fort Worth—S. H. Bothwell, city ... City Hall, water line, Tex. 41-611, ...r. I, incl. approx. 32,000 ft. 20 to 36 in. ... pipeline, appurtenances, Freese & ...ols, 407 Capps Bldg., Fort Worth, engrs., ...r. 2, approx. 25,600 ft. 16 and 20 in. ...pipeline, appurtenances, J. J. Rady, 811 ...rance Bldg., engr. Plans deposit $15 each ...ect.

Bids Asked November 8

..., Chicago—O. E. Hewitt, comr. P. Wks., ... Hall, electrical work in connection with ...th Dist. Filtration Plant on lake front, ... of S. Shore Dr. and north of E. 79 St. ...n deposit $50 ea. set; adv. ENR 10/21.

...V BIDDERS

..., New Orleans—Sewerage & Water Bd., ... Carondelet St., Oct. 7. Contr. 234-W, ...shing, laying approx. 8,700 ft. 2 and 26 ...ll. watermains, from Boh Brothers Constr. ... 2400 Cypress St., **$20,330.** CD 9/28—...R 9/30.

..., La Crosse—City, Oct. 7, drilling well, ...shing pumps and motors, from Layne-...hwest Co., 709 W. 11 St., Milwaukee, ... 1, **$21,993.** CD 8/10—ENR 8/12.

...TRACTS AWARDED

...rizona—U. S. Eng., 751 S. Figueroa St., ... Angeles, 14, Calif., water supply develop- ... Mohave Co., to Bechtel-McCone-Parson. ...W. 5 St., Los Angeles, Calif., **$100,000.** ...rded 9/25.

..., Clarinda—A. E. J. Johnson, city clk., ...imprvs., pump house, 3 pumps, filter plant, ... McGough Bros., 1954 University Ave., ... Paul, Minn., **$68,000.** Dougher, Rich & ...dburn, 310 Old Colony Bldg., Des Moines, ...ts.

...Michigan—U. S. Eng., 700 Union Guardian ..., Detroit, water reservoir, Washtenaw ... to Haberkorn-Barry, 719 Boulevard ..., Detroit, under **$1,000,000.**

...New Jersey—U. S. Eng., 120 Wall St., New ..., 5, N. Y., water supply sys., Essex Co., ...Chas. Simkin Co., 105 Brighton Ave., Perth ...boy, **$25,000.**

..., N. J., Bayonne—Yards & Docks, Navy ..., 18 St. and Constitution Ave. N.W., ...h., D. C., imprvs. and addn. fresh and ... water supply and distr. sys., at Navy ...d. Bayonne Unit, New York Annex, Bay- ..., NOY 7110, to Tuller Constr. Co., 95 Mon- ...th St., Red Bank, **$214,700.** Bids 9/27— ...9/24.

...Okla., Altus—T. O. Burch, mayor, water ...ities, Okla. 34-179, to Boecking Constr. ..., Altus, **$49,773. FWA.** Bids 10/11. CD ...—ENR 9/30.

..., Corpus Christi—A. C. McCaughan, ...or, water pipelines for cross connections ...een large mains and new force main, to ...rn & Root, Inc., Box 1139, Austin, **$47,000.** ...5/19.

SEWERS, WASTE DISPOSAL

...POSED WORK

...nn., Derby—C. F. Caldwell, mayor, sew- ... disposal plant. G. E. Thompson, city ... CD 6/9—ENR 6/17.

...a., LaFitte—Jefferson Parish Sewage ..., sanitary sewerage sys. imprvs., La. ...44, $58,715. **FWA.** R. R. Steinwinder, ... Carrollton, Metairie, engrs.

Location of ENR Correspondents

Symbols and Abbreviations Include:

†	Federal Government
★	Project of $500,000 or over
ENR	Engineering News-Record
CD	Engineering News-Record Construction Daily
A-E-M	Architect-Engineer-Management type of contract

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply	Unclassified
Sewers, Waste Disposal	Latin America
Bridges	Public Buildings
Streets & Roads	Commercial Buildings
Earthwork, Waterways	Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR);

LOW BIDDERS: On jobs below $500,000 value all low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

Note: To comply with censorship requirements, addresses on some reports are being generalized. Data which would reveal the purpose of the improvements and the size are withheld. The name of contractor and general area are reported.

Md., Hagerstown—Fairchild Aircraft Co., storm sewerage sys., and sewage disposal plant. Albert Kahn Associated Architects & Engineers, Inc., 345 New Center Bldg., Detroit, Mich., archts.

Mo., Dixon—City, c/o City Clerk, sewers, manholes, etc. $43,000. Applied for FWA funds. Russell & Axon, 4903 Delmar Blvd., St. Louis, Zone 8, engrs. CD 8/20—ENR 8/26.

Mo., Newburg—Sewerage sys. and disposal plant with auxiliary equip., appurtenances, etc. $134,000. Seeking FWA funds. Russell & Axon, 4903 Delmar Blvd., St. Louis, Zone 8, engrs.

N. J., Teaneck—Town, 1 story, brick sewage disposal plant and pump. station.

†N. M., Bayard—L. Peipelman, mayor, City Hall, sanitary sewerage sys. $60,000. **FWA.** Koch & Fowler, Great National Life Bldg., Dallas, Tex., engrs. CD 6/4—ENR 6/10.

★ **O., Cleveland**—City of Cleveland, S. F. David, dir. Pub. Serv., City Hall, sanitary, storm sewers. $500,000. Bonds to be issued. J. C. Wenrick, City Hall, engr.

†Okla., Braggs—L. Potts, town clk., sewer imprvs., Okla. 34-141A. $52,100. **FWA.** Clonts-Morgan Eng. Co., 416 Court St., Muskogee, engrs.

S. C., Hampton—J. F. Rivers, mayor, City Hall, 4- to 8-in. terra cotta or concrete sewer lines, $30,000, **FWA.** Tomlinson Eng. Co., 1307 Marion St., Columbia, engrs.

Tex., Texas City—E. A. Johnson, mayor, City Hall, sewer imprvs. for Snug Harbor. $38,000. Applied for FWA funds. J. J. Rady, Insurance Bldg., Ft. Worth, engr.

N. B., Newcastle—T. H. Whalen, mayor, exten. sewerage and water mains sys., $70,000. J. W. Murray, Town Hall, engr.

BIDS ASKED

Bids Asked October 29

†Calif., San Pablo—San Pablo Sanitary Dist., Fire House, sanitary sewer mains, Calif. 4-531. **FWA.** Plans deposit $25. P. R. Jones, 2429 MacDonald Ave., Richmond, engrs. CD 9/8—ENR 9/16.

Bids Asked November 2

†La., Pineville—At office of Hon. R. C. Lawrence, mayor, City Hall, laying approx. 6,400 ft. 15 in. outfall sewer line, pump. station. Contr. 4. La. 16-129, $49,000. **FWA.** Plans deposit $2.50. Pan American Engineers, 912 Fifth St., Alexandria, engrs.

Bids Asked

†N. C., Wrightsville Beach—Town, D. Penton, mayor, municipal sewerage sys., NC 31-262. $194,600. **FWA.** P. M. Van Camp, Southern Pines, engr. CD 10/6—ENR 10/14.

LOW BIDDERS

La., New Orleans—Sewerage & Water Bd., 526 Carondelet St., Oct. 7. Contr. 142-S, furnishing, laying approx. 19,200 ft. 6- to 30-in. concrete sewer, from Boh Brothers Constr. Co., 2400 Cypress St., **$84,541.** CD 10/1.

†Tenn., Memphis—W. Chandler, mayor, City Hall, Oct. 12, 2 mi. lateral sewer addn., Tenn. 40-242 NF, from Gregory-Hogan, 115 N. Spring St., Little Rock, Ark., **$52,787. FWA.** CD 9/30—ENR 10/7.

CONTRACTS AWARDED

†Connecticut—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., sewage disposal sys., No. 44-29, Hartford Co., to Lindholm Constr. Co., Inc., 1277 East St., Pittsfield, Mass. **$25,000.** CD 9/21—ENR 9/23.

Minn., Browerville—H. Brenner, village recdr., sewage disposal plant, to Nelson Bros. Constr. Co., Browerville, and Orfel & Mariani, 548 Minnehaha Ave. E., St. Paul. Est. over **$25,000.** Bids 10/1. CD 9/21—ENR 9/23.

O., Cincinnati—Dpt. P. Wks., Div. Records, installing sewers, drains, grading, concrete walks, sodding, to Murdock Constr. Co., 1654 Sherman Ave., Norwood, **$42,063.** Est. $49,927. **(Correction**—contractor). CD 10/5—ENR 10/7. Under LB.

†Oklahoma—U. S. Eng., 231 S. Main St., Denison, Tex., sanitary sewer collection lines, facilities, water supply and distr. sys., natural gas lines, electric outside lighting, etc., Sol. 257-44-53, Comanche Co., to Glade Constr. Co., 403 Century Bldg., Fort Worth, Tex., approx. **$186,000.**

Mo., University City—A. J. Schopp, city clk., City Hall, 6801 Delmar Blvd., Purdue-Waldron-Wellington Relief Sewer, etc., to W. F. Riley & Sons, 8025 Forsythe Blvd., Clayton, St. Louis, Zone 5, **$34,100.** Bids 10/6. CD 9/24—ENR 9/30.

Tex., Houston—Sanitary sewers in portions 3 streets., to Massengale & Sauer, 220 Clifton St., **$25,000.** L. Fugate, City Hall, engr.

†Tex., Port Neches—J. O. Herring, mayor, City Hall, sewer imprvs., Tex. 41-599F, to Thos. Bate & Son, City National Bank Bldg., Houston, **$165,420. FWA.** J. B. Converse & Co., Inc., Dallas and Lakeshare Sts., Port Arthur, engrs. CD 9/28.

BRIDGES

PROPOSED WORK

Kan., Kansas City—City, c/o R. Wheat, chn. Bd. Comrs. Wyandotte Co., Kansas City, Kan., rebuilding Central Ave. viaduct, incl. cleaning, painting superstructure and hand rails, widening and super-elevating curve on east section, concrete and asphalt mix resurfacing, widening curve from present 20 to 27 ft. $59,019. Sverdrup & Parcel, Railway Exch. Bldg., St. Louis, Mo., consult. engrs.

O., Cleveland—S. F. David, dir. Pub. Serv., City Hall, replacing concrete, steel for Clark Ave. Bridge. To exceed $25,000. J. M. Heffelfinger, 518 City Hall, engr.

†Alaska, Ketchikan—City, City Hall, redecking, repiling viaduct on Water and Dock Sts. $31,000. **FWA.**

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IDGES, etc. (Cont'd.)

DS ASKED

Bids Asked October 27

Louisiana—State Hy. Dpt., Baton Rouge, pairing 2 timber pile trestles, etc. 0.166 mi. ander-Hineston Hy., SP 29-05-06, DAAR oject DA-WR 28(1), Rapides Parish.

Bids Asked October 28

Nebraska—State Dpt. Rd. & Irrigation, W. Scott, engr., Lincoln, grading, concrete pav- 1 bridge at Sta. 74 plus 79.73, Table k-Verdon, Proj. 43-F, FA-WPH, and grad- sand gravel surfacing culverts, 1 bridge Sta. 40 plus 45.88, Auburn-Brownville, Proj. F, FA-472-A.

Bids Asked October 29

Wisconsin — State Hy. Comn., Madison, idge 872, North Water St. Bridge, S. P. State Trunk Hys. 27 and 71, Contr. 1, Sparta, Monroe Co. CD 6/22—6/24, under arta.

NTRACTS AWARDED

Arkansas—U. S. Eng., 300 Bway., Little ck, bridge, roads and drainage structures, str. 03-050-Eng-11, Baxter Co., to Cart- ight Constr. Co., Walnut Ridge, **$80,000.**

Florida—U. S. Eng., 575 Riverside Ave., cksonville, Zone 2, dolphins from Sisters eek Bridge and Kingsley Creek Bridges, racoastal Waterway Cumberland Sound to Johns River Section, Neg-Jax-44-217, val Co., to Burke Constr. Co., Masonic dg., Jacksonville, Zone 2, approx. **$30,000.** arded 10/6.

STREETS AND ROADS

DS ASKED

Bids Asked October 25

New Jersey—Spencer Miller, Jr., comr. te Hy. Dpt., Trenton, bituminous concrete ving, etc., 5.481 mi. Knickerbocker Rd. Livingston Ave., from Madison Ave., Cress- l to New York state line, F.P. DA-WR-14, rgen Co. Plans deposit $10.

Bids Asked October 26

Conn., New Haven—City, Eng. Dpt., Hall of cords, asphaltic concrete on rein.-con. pav- River and James Sts. Over $25,000.

Bids Asked October 27

Arkansas—J. H. Crain, chn. State Hy. Dpt., tle Rock, grading, minor drainage, bi- minous on gravel surfacing 5.543 mi. Petu n Rd., Conway Co. $140,000.

Louisiana—State Hy. Dpt., Baton Rouge, prv. 0.166 mi. road, repairing 2 pile timber dges on Leander-Hineston Hy., S.P. 29-05- Defense Access Army Reservation Project -WR-28, Rapides Parish.

Bids Asked November 2

Calif., Benicia—Street paving. $261,054. ns deposit $10, P. Jones, 2429 McDonald ., Richmond, engr.

Florida—State Rd. Dpt., Tallahassee, pav- treated timber bridge, Access Rd. Project -NR-25-A (1) Operating 4554, Rd. 594, be- en Rd. 37 and Whiting Field, Santa Rosa J. H. Dowling, Tallahassee, state hy. engr.

Bids Asked

California—State Div. Hys., Sacramento, re- ted bids Oct. 7, imprv. 0.5 mi. Ventura Co. 10/12—ENR 10/14 under LB.

Massachusetts—U. S. Eng., 31 St. James , Boston, (selected list bidders), grading, d construction, No. 19-023-43-NEG 96, nstable Co. $40,000.

Tex., McAllen—Dpt. Agriculture, Farm urity Admin., Parry at Commerce Sts., as, rejected bids Sept. 28, repairing, sur- ing roads, Hidalgo Co. May readvertise. 9/21.

W BIDDERS

Alabama—State Hy. Dpt., Montgomery, 1, grading, drainage, asphalt surface tment, 6.621 mi. Russell Co., from Carlton tracting Co., Albany, Ga., **$177,564.** CD .

California—State Div. Hys., Sacramento, 15, grading, plant mix and asphaltic ncrete paving 5.5 mi. in Vallejo Twp., Pro- 2, Dist. X, Salono Co., from L. J. Immel, 55, Sta. A, Berkley, **$92,740.** CD 10/8.

California—Pub. Rds. Admin., Phelan Bldg., Francisco, Oct. 13, constr. 4.534 mi. ndy City Timber Access Rd., Sierra Co., n John Carlin Constr. Co., Box 698, Arcata, ,968.

California—State Div. Hys., Sacramento. 13, imprv. 4.7 mi. Solano Co., from Piazza Hunley, 175 S. Montgomery St., San Jose, 677. G. T McCoy, state hy. engr.

District of Columbia and Maryland—Pub. ds Admin., 1449 Columbia Pike, Arlington, Oct. 12, Proj. B-1, military hy., District Columbia to Prince Georges Co., Md., from a & Callahan Contg. Co., Inc., 500 W. t., Baltimore, Md., **$210,185.** CD 10/6.

D. C., Wash.—District Comrs., District Bldg., Oct. 11, imprv. various roadways, from Highway Engr. & Constr. Co., Inc., 7 and T Sts. N.E., **$113,821.** CD 10/8.

Indiana—State Hy. Comn., Indianapolis, Oct. 12, imprv. 0.37 mi. Madison Co., from Calumet Paving Co., Union Title Bldg., Indianapolis, **$63,755,** est. $74,617***15.288 mi. Huntington, Whitley and Allen Counties, from John Dehner, Inc., 1026 Clark St., Ft. Wayne, **$46,352,** est. $62,038***16.4 mi. Delaware and Jay Counties, from Gradle Bros., Carmel, **$49,934,** est. $56,309. Received no bids Oct. 12, imprv. 1.6 mi. U.S. Road 50, Dearborn Co.; 2 mi. State Rds. 32 and 67, Madison Co. CD 9/28—ENR 9/30.

Kentucky—State Hy. Dpt., Frankfort, Oct. 13, imprv. 1.472 mi. Floyd Co., from J. C. Codell & Co., Winchester, **$28,089.** CD 10/5—ENR 10/7.

★**Ohio**—State Hy. Dpt., Columbus, Oct. 5, imprv. 1.647 mi. Trumbull Co., from A. J. Baltes, Inc., 11 Olive St., Norwalk, **$404,994,** est. $403,200; 6.566 mi. Portage Co., from the McCourt Constr. Co., 720 Home Ave., Akron, **$219,160,** est. $185,300.

†**R. I., Newport**—Federal Works Agency, 101 Park Ave., New York, 17, N. Y., road repairs, from Callan Constr. Co., 349 Hope St., Bristol, **$54,730.**

CONTRACTS AWARDED

†**California**—U. S. Eng., 74 New Montgomery St., San Francisco, paving, Contr. 04-203-Eng-173, Solano Co., to Ford J. Twaits Co., 451 Boyleston St., Los Angeles, **$100,000.**

†**Calif., San Leandro**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., roadways, earthwork, Naval Hospital, NOY 7734, to MacDonald & Kahn, 100 Financial Center Bldg., San Francisco, **$194,560.**

†**Colorado**—U. S. Eng., 1709 Jackson St., Omaha, Neb., razing, reconstructing portion hy., Contr. 25-066-Eng-187. Eagle Co., to Brown Constr. Co., Pueblo, **$70,000.**

†**Connecticut**—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., road work, No. 44-39, Hartford Co., to Lane Constr. Corp., 37 Colony St., Meriden. Est. **$50,000-$100,000.** CD 10/12—ENR 10/14.

†**Fla., Jacksonville**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., road to shot gun range, NAGS, NOY 7076, to Hall & Caddell, 2014 Derris, Jacksonville, **$30,325.**

Georgia—State Hy. Dpt., Atlanta, Oct. 8, imprv. 0.878 mi. Cobb Co., to McDougald Constr. Co., Northside Dr., Atlanta, **$82,590.** Bids 10/8. CD 10/8—ENR 10/14.

†**Indiana**—U. S. Eng., 612 Federal Bldg., Louisville, Ky., widening roadways, Contr. 15-029-Eng-78, Clark Co., to George M. Eady Co., 340 Byrne St., Louisville, Ky., **$40,000.**

†**Massachusetts**—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., access road, Bristol Co., to Carlo Bianchi & Co., Inc., 24 Union Ave., Framingham. Est. **$50,000-$100,000.**

†**Massachusetts**—U. S. Eng., 131 St. James Ave., Boston, grading, roadwork and temporary frame bldgs., Contr. 19-023-Eng-80, Middlesex Co., to C. J. Maney Co., Inc., Somerville, **$200,000.**

†**Nebraska**—U. S. Eng., 1709 Jackson St., Omaha, stabilized gravel surfacing, Buffalo Co., to Green & Groesbeck, 312 Masonic Temple Bldg., Des Moines, Ia., under **$50,000.**

†**New Jersey**—U. S. Eng., 120 Wall St., New York 5, N. Y., grading, excavating, constructing water distr. sys., Middlesex Co., to LaFera-Grecco Const. Co., 149 Verona Ave., Newark, **$25,000.**

†**New York**—U. S. Eng., Chimes Bldg., Syracuse, roads, facilities, Contr. 321-Eng-1012, Onondaga Co., to D. W. Winkelman, Heffernan Bldg., Syracuse, **$50,000.**

†**North Carolina**—U. S. Eng., 308 Customhouse, Wilmington, paving, clearing, grubbing, Moore Co., to E. W. Grannis, Fayetteville. Est. under **$100,000.** Awarded 10/12.

Ohio—State Hy. Dpt., Columbus, imprv. 5.77 mi. Hamilton Co., to L. R. Geiler, Box 98, Rossmoyne, **$57,374,** est. $56,500***4.307 mi. Paulding Co., to S. E. Johnson Co., 218 Terminal Bldg., Toledo, **$94,703,** est. $97,500*** 1.39 mi. Lucas and Wood Counties, to Arthur S. Langenderfer & Co., 4690 W. Bancroft St., Toledo, **$24,696,** est. $24,500. Grand total $176,773. Rejected bids Oct. 5, imprv. 2.264 mi. Coshocton Co., $35,800; 0.282 mi. Holmes Co., $3,050; 1.181 mi. Jackson Co., $39,500; 2.03 mi. Licking Co., $23,800. Cancelled bids to have been opened Oct. 5, imprv. 0.0415 mi. Putnam Co. CD 9/20—ENR 9/23.

†**Oklahoma**—U. S. Eng., 231 W. Main St., Denison, Tex., grading, drainage, streets and railroads, Contr. 41-242-Eng-18, Comanche Co., to Glade Constr. Co., 413 E. 4 St., Fort Worth, Tex., **$30,000.**

Oklahoma—State Hy. Comn., Oklahoma City, imprv. 0.534 mi. U. S. 81, Stephens Co., to J. A. Briscoe, Stillwater, **$37,650,** est. $39,200***0.543 mi., Cleveland Co., to Brooks & Dahlgren, Insurance Bldg., Oklahoma City, **$37,445,** est. $41,600***0.674 mi. U. S. 64, Muskogee Co., to Standard Paving Co., 2119 East 11 St., Tulsa, **$216,481,** est. $230,000. Grand total $291,576. Bids 10/11. B. E. Clark, Capitol Bldg., Oklahoma City, engr.

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STREETS & ROADS (Contracts Awarded, Cont'd.)

†Oklahoma—U. E. Eng., 416 Wright Bldg., Tulsa, Zone 2, bituminous paving. McClain Co., to Richards & Mullinix, 1401 N.W. 5 St., Oklahoma City, **$55,000.**

Oregon—State Hy. Comn., Public Service Bldg., Portland, to Western Rock Co., Salem, imprv. 1.23 mi. Umatilla Co., **$26,824*****to Rogers Construction Co., Dayton, Wash., imprv. Baker and Malheur Counties, **$98,524*****to Iscar E. Jolson, Eugene, Umatilla Co., **$33,940*****to E. C. Hall Co., Eugene, Wasco Co., **$29,850;** Jackson Co., **$25,900;** Deschutes and Klamath Counties, **$55,000;** Crook and Deschutes Counties, **$46,800.** Grand total $316,838. CD 10/1.

†Oregon—Pub. Roads Admin., U. S. Court House, Portland, subgrade, shoulders, grading 13.5 mi. Little River timber access Rd., Douglas Co., to A. Milne Constr. Co., 7253 N.E. Bway., Portland, approx. **$80,000.** Awarded 10/12.

†Texas—U. S. Eng., 25 St. and Avenue F, Galveston, addnl. asphalt paving street and driveway, Cameron Co., to H. Hedges & Son, 1910 Runnels St., Houston, **$30,000.**

Utah—State Rd. Comn., State Capitol, Salt Lake City, imprvs. 4.484 mi. Utah Co., to W. E. Ryberg, Strong & Grant, Terminal Bldg., Salt Lake City, Zone 1, **$167,805.** Est. $198,270. Bids 9/29. CD 9/22.

Utah—State Road Comn., Salt Lake City, imprv. 8.582 mi. Tooele Co., to Carl Nelson, Logan, **$92,958.** Est. $115,500. Bids 10/8.

†Washington—U. S. Eng., 800 3 Ave., Seattle, Zone 4, regrading, Kittitas Co., to S. Birch & Sons Constr. Co., Ellensburg. **$100,000.**

Que., Ste Emelie—Province of Quebec, c/o Ministry of Roads, Quebec City, graveling 5½ mi. road, to N. Trudel & Sons, Ste Irenee, **$50,000.** E. Gohier, Dpt. Roads, Quebec City, engr.

EARTHWORK, WATERWAYS

PROPOSED WORK

Man., St. Boniface—Open ditch to drain surplus Springfield water into the Seine River 1¼ mi. $15,000 voted. J. A. Bibeau, Town Hall, engr.

New Jersey—State Dpt. Agencies & Institutions, Trenton, received no bids Oct. 11, earth excav. at Jaqui Pond, Greystone Park Hospital, Morris Plains Boro, Morris Co. CD 9/22—ENR 9/30.

BIDS ASKED

Bids Asked October 25

Conn., East Lyme—State of Connecticut, Office Comptroller, State Capitol, Hartford, reconstructing, imprv. dam in Pataganset Lake.

†Va., Gravelly Point—Pub. Bldgs. Admin., 18 and F Sts. N.W., Wash., D. C., retaining wall, storage bldg. Bids 7/30 rejected. CD 8/3.

Bids Asked October 27

Arkansas—J. H. Crain, chn. State Hy. Dpt., Little Rock, bank protection on Arkansas River, Jefferson Co., $65,000; on White River, Prairie Co., $70,000, W. W. Mitchell, hy. engr.

†Louisiana—U. S. Eng., foot of Prytania St., New Orleans, approx. 270,000 cu. yd. earthwork in Mississippi River levees.

Bids Asked November 15

†California—Bureau of Reclamation, Courthouse, Denver, Colo., furnishing, del. two 10 ft. 6 in. x 11 ft. 9 in. radial gates with wall plates, gate sills, pin bearings, accessories and two 5,000 lb. manually operated gate hoists with wire ropes, sockets, turnbuckles for installation at inlet and wasteway structure of Fresno River siphon, Madera Canal, Friant Div., Central Valley Proj., Spec. 1705-D.

LOW BIDDERS

Calif., Long Beach—E. J. Amar, port mgr., c/o City Harbor Dpt., 1333 W. El Embarcadero, Oct. 5, clay dike and rock revetment, etc., from Standard Dredging Co., Bert 207, San Pedro, **$167,880.** CD 9/24.

★**†Colorado**—Bureau of Reclamation, Custom House, Denver, Oct. 11, Shadow Mountain Dam and dikes constr., Colorado-Big Thompson project, Spec. 1059, Schedule 1, from J. F. Shea, Inc., 617 S. Olive St., Los Angeles, Calif., **$440,740;** Schedule 2, from Gordon Constr. Co., 1900 31 St., Denver, **$754,820.** CD 9/20—ENR 9/23.

†Washington — Bureau of Reclamation, Yakima, Oct. 12, Sect. 1, Yakima Ridge Canal, Roza Div., Yakima Project, Spec. 1060, from A. Osberg & C. Ludenberg, 502 N. 62 St., Seattle, Zone 3, **$447,034;** Sect. 2, from Northwest Eng. Co., Rapid City, S. D., **$252,306.** CD 9/15—ENR 9/23.

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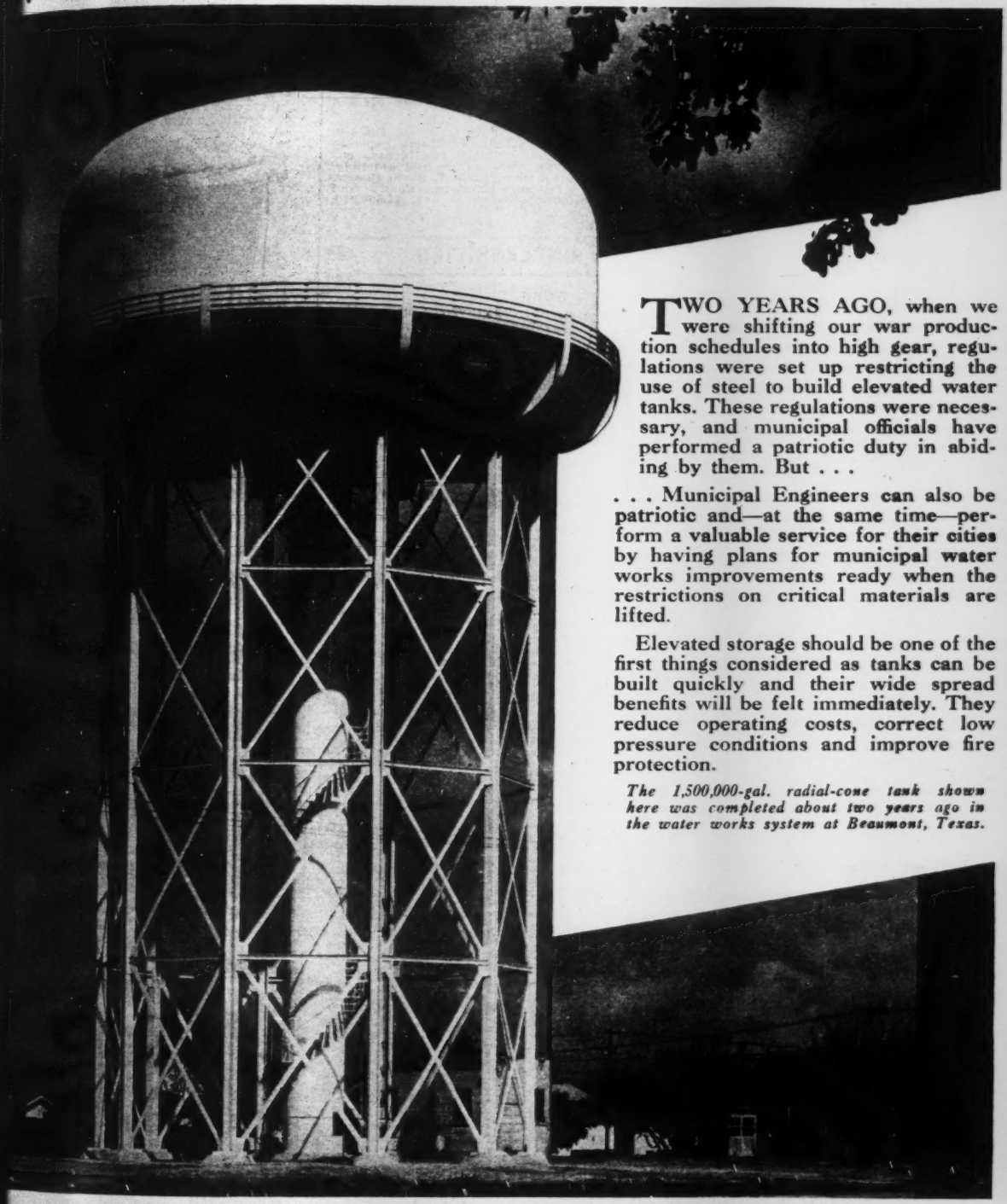

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. . . Municipal Engineers can also be patriotic and—at the same time—perform a valuable service for their cities by having plans for municipal water works improvements ready when the restrictions on critical materials are lifted.

Elevated storage should be one of the first things considered as tanks can be built quickly and their wide spread benefits will be felt immediately. They reduce operating costs, correct low pressure conditions and improve fire protection.

The 1,500,000-gal. radial-cone tank shown here was completed about two years ago in the water works system at Beaumont, Texas.

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...land 15.....2201 Guildhall Bldg.	Birmingham 1.....1520 North Fiftieth Street	San Francisco 5.....1020 Rialto Bldg.

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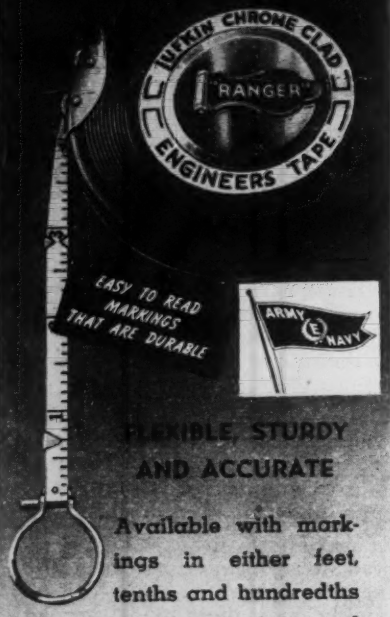
CHROME CLAD "RANGER" STEEL TAPE



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The jet black markings stand out against the satin chrome finish, can be read easily even in poor or artificial light. The surface won't rust, crack, chip or peel. Flexible, sturdy ¼" line. Tough genuine leather case gives extra wear. Write for free catalog.

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EARTHWORK & WATERWAYS (Cont'd.)

CONTRACTS AWARDED

†Arkansas—U. S. Eng., U. S. Post Office and Courthouse, Vicksburg, Miss., repairing, exten. Pine Bluff bank protection, south bank Arkansas River, Sol. 22-052-44-22, Pine Bluff, Jefferson Co., to W. P. George, Box 995, Pine Bluff, **$202,900.** CD 9/20—ENR 9/23.

†Oklahoma—U. S. Eng., 416 Wright Bldg., Tulsa, Zone 2, levee, left bank of Arkansas River, Sol., 957-Neg-44-51, Tulsa Co., to Ottinger Bros., Braniff Bldg., Oklahoma City, **$66,000.** CD 9/8.

Mississippi—State Hy. Comn., E. D. Kenna, dir., Lamar Life Bldg., Jackson, channel change, 0.482 mi. Miss FAP-176-(B)2, Claiborne Co., to F. S. Neely, Jackson, **$28,000.** Est. $50,000. Bids 10/12. CD 9/30.

★**S. C., Lexington**—South Carolina Electric & Gas Co., Columbia, increasing capacity spillway at Saluda dam, Lake Murray, enlarging fill on downstream slope and widening, paving hy. across dam, to A. I. Savin Constr. Co., 10 Village St., Hartford, Conn., and Carolina Life Bldg., Columbia, over **$1,000,000.** CD 10/12.

UNCLASSIFIED

PROPOSED WORK

★**†California**—CONSTRUCTION—U. S. Eng., 751 S. Figueroa St., Los Angeles, construction at Army Air Force installation, Los Angeles Co. Approx. $1,000,000.

†California—RAILROAD—U. S. Eng., 74 New Montgomery St., San Francisco, railroad, Spec. 947-A, central California.

†California — UTILITIES — U. S. Eng., 74 New Montgomery St., San Francisco, utilities, Spec. 1145, San Francisco Co.

Louisiana—OIL WELL—Sinclair Oil Co., Gulf Bldg., Houston, Tex., drilling, casing, developing oil well, earthen storage, fuel line, etc. East Baton Rouge Parish.

Louisiana—OIL WELL—Union Producing Co., Oil & Gas Bldg., Houston, Tex., drilling, developing 10,500 ft. oil well, storage, etc., Terrebonne Parish. Over $25,000.

Louisiana — PIPELINE, etc. — Continental Oil Co., Lake Charles, installing pipeline across Gulf-Intracoastal Water Way, Mermentau River-Calcasieu Sect., and dredging slip, at point approx. 918 ft. southerly from ferry at point where State Hy. 913 intersects waterway, about 15 mi. south from Lake Charles, Cameron Parish.

La., Evangeline—OIL WELL—Gulf Oil Co., Gulf Bldg., Houston, Tex., drilling, developing new 11,000 ft. oil well, storage. Over $25,000.

La., Lafayette—SWIMMING POOL, etc.—Southwestern Louisiana Institute, plans by Favrot & Reed, Nola Bldg., New Orleans, swimming pool, bldgs. $100,000. CD 9/13—ENR 9/16.

†Minnesota—RURAL ELECTRIC DISTRIBUTION LINE CONNECTIONS—Douglas Co. Cooperative Light & Power Assn., Alexandria, rural electric distr. line connections, Douglas Co. $100,000. REA allot.

†Minnesota—RURAL ELECTRIC DISTRIBUTION LINE CONNECTIONS—Lake Region Cooperative Elec. Assn., Pelican Rapids, rural electric distr. line connections, Ottertail Co. $98,000. REA allot.

†Minnesota—RURAL ELECTRIC DISTRIBUTION LINE CONNECTIONS—Minnesota Valley Cooperative Light & Power Assn., Chippewa, rural electric distr. line connections, Chippewa Co. $50,000. REA allot.

Neb., Omaha—ATHLETIC FIELD, etc.—Bd. Educ., City Hall, athletic field and football stadium. $100,000. J. Latenser & Sons, 1406 Farnam St., engrs.

†N. C., Greenville—AIRPORT—Civil Aeronautics Admin., 18 St. and Constitution Ave. N.W., Wash., D. C., airport exten.

†Pennsylvania—FACILITIES—U. S. Eng., 925 New Federal Bldg., Pittsburgh, addnl. facilities, Dauphin Co. Lacy & Atherton, Middletown, archts.

Texas—GAS PIPELINE—West Texas Utilities Co., San Angelo, 21 mi. 6 in. pipeline (gas) carrier between point in Pecos Co. to power plant near Girvin. $70,000.

†Texas—IMPROVEMENTS—U. S. Eng., 25 St. and Avenue F, Galveston, imprvs., Sol. 41-243-44-C57, Cameron Co.

Texas — INJECTION WELL — East Texas Salt Water Disposal Co., Tyler, drilling, developing new salt water injection well. $100,000.

Tex., Bethel (mail Tennessee Colony)—OIL WELLS—Superior Oil Co. of California, Oil & Gas Bldg., Houston, drilling, casing, developing 1 or more oil wells. Over $25,000.

Tex., Rankin—OIL WELL—Maloney Drilling Co., W. H. C. Goode, Rankin, drilling, developing 4,000 ft. oil well, earthen storage, fuel line, etc.

Tex., Van—OIL WELL—Delta Drilling Co., et al, Tyler, drilling, developing 8,500 ft. oil well.

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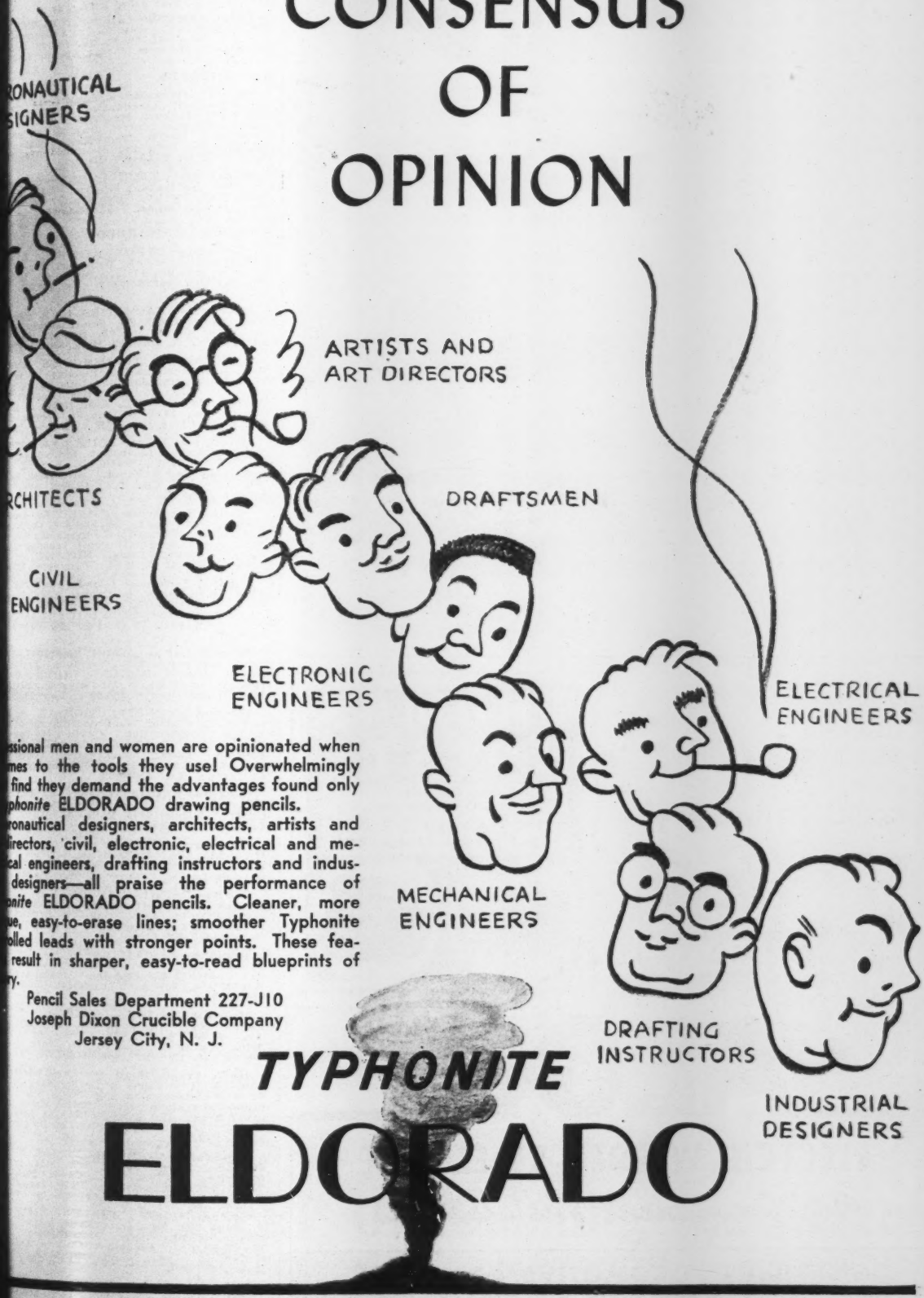

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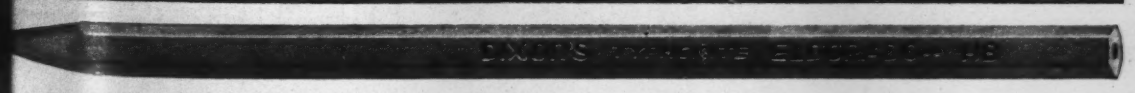

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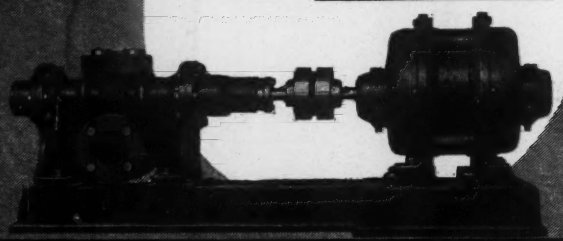

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UNCLASSIFIED (Cont'd.)

BIDS ASKED

Bids Asked October 26

†**Wis., Janesville**—AIRPORT PAVING, Civil Aeronautics Admin., 105 S. Dearborn, Chicago, Ill., 337,250 sq. yd. paving, seeding 35 acres, 1,300 rods fencing, etc., for Rock

LOW BIDDERS

†**N. Y. Dansville**—AIRPORT IMPROVEMENTS—Civil Aeronautics Admin., Ladia Field, Jackson Heights, Sept. 30, airp imprvs., erosion control, draining and seed Prop. No. 14-256, from New England Expert Co., Inc., 539 Smithfield Ave., Pa tucket, R. I., **$25,846.** CD 9/22.

†**Oklahoma**—IMPROVEMENTS—U. S. Bu 231 W. Main St., Denison, Tex., impr bldgs., Carter Co., from United Constr. Burt Bldg., Dallas, Tex., **$169,000.**

CONTRACTS AWARDED

†**Alabama**—IMPROVEMENTS—U. S. En Grant St. west of Westwood St., Mob imprvs., Inv. 569-44-117. Macon Co., to R. Royster Co., Montgomery. Est. **$40,000.** 9/22.

†**California**—FACILITIES—U. S. Eng., New Montgomery St., San Francisco, add facilities, Contr. 04-203, Eng-169, San L Obispo Co., to Howson Bros., Gilroy, **$36,**

†**California** — TRANSMISSION LINE Bureau of Reclamation, Redding, 100 mi. kilovolt transmission line from Shasta po plant to Oroville substation, Kennett D Central Valley Proj., Spec. 1056, to Lar Constr. Co., 2811 Walnut St., Denver, Co **$258,841.** CD 8/20—ENR 8/26 under LB.

†**Calif., San Diego**—BOILER FACILITIES Yards & Docks, Navy Dpt., 18 St. and Con tution Ave. N.W., Wash., D. C., addnl. boi facilities, Camp Elliott, NOY 6549, to Field Constr. Co., 2650 Cherry Ave., L Beach, **$58,713.**

†**Calif., San Pedro**—FACILITIES—Yards Docks, Navy Dpt., 18 St. and Constitu Ave. N.W., Wash., D. C., expanding facili Installation B, Small Craft Training Cen Naval Operating Base, NOY 7401, to Constr. Co., 740 W. E St., Wilmington, $33

†**Calif., Terminal Island**—DOCKING CILITIES—Yards & Docks, Navy Dpt., St. and Constitution Ave. N.W., Wash., D. docking facilities, NOB, NOY 6858, to War Southwest, Inc., P. O. Box 386, Wilming **$158,000.**

†**Connecticut** — IMPROVEMENTS — U. Eng., 819 Industrial Trust Bldg., Providen R. I., imprvs., No. 44-40, Hartford Co., Henley-Lundgren Co., 524 River St., Mattap Mass. Est. under **$50,000.** Bids 10/8.

†**Florida** — CONSTRUCTION — U. S. En Grant St. west of Westwood St., Mobile, A addnl. construction, Contr. 569-Eng-54 Bay Co., to The Jordan Co., Columbus, G **$200,000;** addnl. construction, Contr. Eng-5430, Bay Co., to Williams Constr. C Columbus, Ga., **$100,000.**

†**Florida**—FACILITIES—U. S. Eng., Riverside Ave., Jacksonville, Zone 2, facili Contr. 436-Eng-10743, Polk Co., to J. L. Ew Lakeland, **$30,000.**

†**Florida**—TAXIWAY, etc.—U. S. Eng., Riverside Ave., Jacksonville, taxiway, apro roads, Neg-Jax-44-233, Osceola Co., to Lan ton Constr. Co., Orlando, approx. **$90,000.**

†**Idaho**—PARKING APRON—U. S. Eng., Pittock Blk., Portland, Ore., exten. park apron, Contr. 35-026-Eng-226, Bannock C to Morrison-Knudsen Co., Inc., 319 Bw Boise, **$400,000.**

†**Indiana**—FACILITIES—U. S. Eng., Federal Bldg., Louisville, Ky., addnl. fac ties, Contr. 15-029-Eng-75, Allen Co., to The Rogoff Co., 306 S. Wabash St., Chicago, **$200,000.**

†**Ind., Bunker Hill** — SEEDING — Yards Docks, Navy Dpt., 18 St. and Constitu Ave. N.W., Wash., D. C., seeding outly fields, Naval Air Station, NOY 7826, to B ers Impvt. Co., Bruceville, **$37,970.**

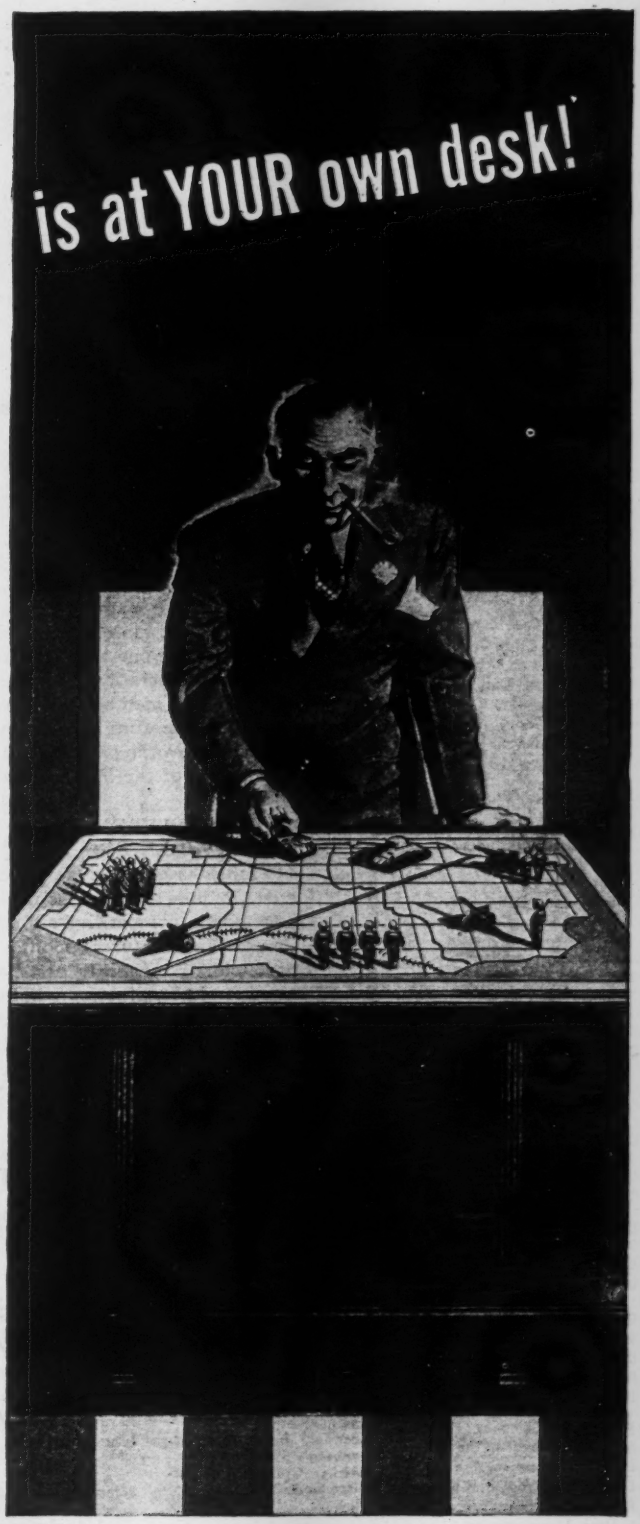
†**Ind., Crane (mail Stockwell)**—LOADI DOCKS, etc.—Yards & Docks, Navy Dpt., St. and Constitution Ave. N.W., Wash. D piping to transfer depot loading docks, bo proof group and kennels, N A D, NOY 7 to Birmingham Contracting Co., Birmingha Mich., **$49,750.**

†**Louisiana**—IMPROVEMENTS—U. S. En 300 Bway., Little Rock, Ark., bldg., impr facilities, utilities, etc., Caddo Parish, Wood Eng. & Constr. Co., Tyler, Tex., $5 Bids 10/5. CD 9/28.

†**Maine**—NIGHT LIGHTING SYSTEM S. Eng., 131 St. James Ave., Boston, Ma night lighting sys. reconstruction, Cu 19-023-Eng-86, Aroostook Co., to Anders Coffey Co., Inc., 22 Shawmount St., Bos Mass., **$40,000.**

†**Me., Brunswick**—RAILROAD SIDIN Yards & Docks, Navy Dpt., 18 St. and Cons tution Ave. N.W., Wash., D. C., railroad ing, Naval Air Station, NOY 4789, to Wy & Simpson, Inc., 238 Water St., Augu **$48,000.** CD 9/30.

or THIS battle, G.H.Q. is at YOUR own desk!



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Gurley, W. & L. E.

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Infilco, Incorporated
Iowa Valve Co.

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Johns-Manville Sales Corp.
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Jones Company, James

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Kennedy Valve Mfg. Co., The

Lakeside Engineering Corp.
Layne & Bowler, Inc.
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Lead Lined Iron Pipe Company
Leadite Company, The
Limestone Products Corp. of America
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Lynchburg Foundry Co.

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National Water Main Cleaning Co.
Neptune Meter Company
Niagara Alkali Company
Nichols Engineering & Research Corp.
Norwood Engineering Company, The

Omega Machine Company

Pacific Flush-Tank Company
Pacific States Cast Iron Pipe Co.
Pelton Water Wheel Company, The
Pennsylvania Salt Mfg. Co.
Permutit Company, The
Phoenix Meter Corporation
Pitometer Co., Inc., The
Pittsburgh-Des Moines Steel Co.
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Sparling, R. W.
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CLASSIFIED (Contracts Awarded, Cont'd.)

Massachusetts—FIRE PROTECTION—U. Eng. 131 St. James Ave., Boston, fire pro- tion, No. 19-023-44-Neg-83, to H. G. Vogel 141 Milk St., Boston, **$41,000.**

Mississippi — FACILITIES — U. S. Eng., st St. west of Westwood St., Mobile, Ala., l. facilities, Inv. 569-44-100, Forrest Co., H. Taylor & J. L. Wheless, Hattiesburg, r **$50,000.** Bids 9/17, awarded 10/9.

Mississippi—IMPROVEMENTS—U. S. Eng., st St. west of Westwood St., Mobile, Ala., rvs., Inv. No. 569-44-118, Forrest Co., to n & Hamilton, Hattiesburg, under **$50,000.** s 9/28, awarded 10/8.

Nebraska—IMPROVEMENTS—U. S. Eng., Jackson St., Omaha, imprvs., bldgs., es Co., to C. C. Larsen & Sons, 10 N. n St., Council Bluffs, Ia. Est. under 0,000.

Minnesota—SPRINKLER SYSTEM—U. S. 1709 Jackson St., Omaha, Neb., auto- ic sprinkler sys., Ramsey Co., to Grinnell Inc., 260 W. Exchange St., Providence, I. Est. under **$50,000.**

Missouri—IMPROVEMENTS—U. S. Eng., E. 17 St., Kansas City, Mo., imprvs., addnl. s. Buchanan Co., to Lehr Constr. Co., 5 Frederick St., St. Joseph, under **$100,000.**

Montana—IMPROVEMENTS—U. S. Eng., inistration Bldg., Fort Peck, imprvs., s. Clark Co., to Dudley-Anderson Co., t Falls. Est. under **$50,000.**

Nebraska—COAL STORAGE AREA, etc.— S. Eng., 1709 Jackson St., Omaha, coal rage area and railroad track, Box Butte to O. Mann, Rapid City, S. D., under 000.

Nebraska—IMPROVEMENTS—U. S. Eng., Jackson St., Omaha, imprvs., Clay Co., Peter Kiewit Sons Co., Omaha Natl. Bank g., Omaha. Est. under **$50,000.**

Nebraska—IMPROVEMENTS—U. S. Eng., Jackson St., Omaha, imprvs., Scottsbluff to Inland Constr. Co., 30 and Leaven- th Sts., Omaha. Est. under **$100,000.**

Nebraska—IMPROVEMENTS—U. S. Eng., Jackson St., Omaha, Neb., imprvs., Fill- e Co., to Peter Kiewit Sons Co., Omaha l Bank Bldg., Omaha. Est. under **$50,000.**

Nebraska—IMPROVEMENTS—U. S. Eng., Jackson St., Omaha, imprvs., bldgs., ver Co., to Freeman Contractors, Inc., Col- do Springs, Colo. Est. under **$50,000.**

Nebraska—IMPROVEMENTS—U. S. Eng., Jackson St., Omaha, imprvs., Scotts Bluff to Inland Constr. Co., 3867 Leavenworth Omaha, under **$100,000.**

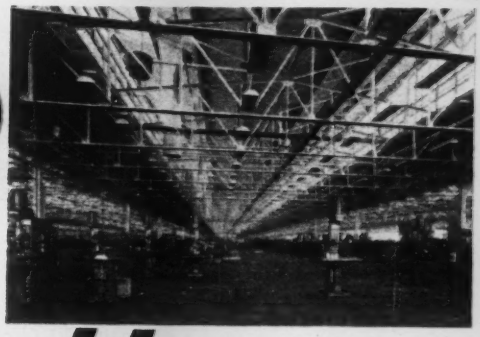
Nebraska — RAILROAD TRACK — U. S. 1709 Jackson St., Omaha, railroad track, falo Co., to Rentlor Co., Kearney, under 000.

New Jersey—RAILROAD—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. Wash., D. C., railroad, NAD, Earle, NOY to Geo. M. Brewster, 1127 Shoreham Wash., D. C., **$2,370,000.** CD 10/4, ee CA.

New Jersey—RANGES—U. S. Eng., 6 and nut Sts., Phila., Pa., addnl. ranges, Contr. Eng-4925, Cumberland Co., to Hill & Fox, geton, **$80,000.**

N. J., Atlantic City—PARKING APRON— ds & Docks, Navy Dpt., 18 St. and Con- tion Ave. N.W., Wash., D. C., parking n addn., Naval Air Station, NOY 7215, to n Paving Co., 1227 N. Broad St., Phila., **$139,000.**

New York—RAMP—U. S. Eng., 120 Wall New York, Zone 5, ramp, Contr. 30-075- -196, Kings Co., to John Milnes Co., 2081 mond Terrace, Port Richmond, **$30,000.**



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UNCLASSIFIED (Contracts Awarded, Cont'd.)

★†**North Carolina**—AVIATION FACILITIES—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., aviation facilities, Kinston Field, M. C. A. S., Cherry Point, NOY 7627, to H. L. Coble, Greensboro, **$1,073,300.** CD 10/12, under CA.

†**North Carolina**—DOLPHINS—U. S. Eng., 308 Customhouse, Wilmington, tie-up dolphins, Carteret Co., to T. A. Loving & Co., Goldsboro, under **$50,000.**

†**North Carolina**—GRASSING, etc.—U. S. Eng., 308 Customhouse, Wilmington, grassing, fertilizing, Carteret Co., to Southern Mapping & Eng. Co., Greensboro, under **$50,000.** Awarded 10/10.

N. D., Fargo — IMPROVEMENTS — City, imprvs., to T. F. Powers Constr. Co., 217 4th Ave. N., **$58,695.** CD 9/28.

†**Oklahoma**—ELECTRICAL DISTRIBUTION SYSTEM, etc.—U. S. Eng., 231 W. Main St., Denison, Tex., outside electrical distr. sys., street lighting, etc., Comanche Co., to J. & J. Electric Co., Box 365, Oklahoma City, **$27,000.**

†**Oklahoma**—FUEL OIL STAND-BY FACILITIES—U. S. Eng., 416 Wright Bldg., Tulsa, Zone 2, fuel oil stand-by facilities, Sol. 957-neg-44-66, Oklahoma Co., to H. J. Happel & Co., 906 Manhattan Bldg., Muskogee, **$28,000.**

Okla., Ponca City—DAM and SPILLWAY—L. A. Cann, city mgr., and C. F. Norton, clk., repairing dam and spillway, Sects. B and C, to Guy H. James Constr. Co., 2314 First Natl. Bank Bldg., Oklahoma City, **$29,125.** Burns & McDonnell, 107 West Linwood Blvd., Kansas City, Mo., engrs.

†**Pennsylvania**—FACILITIES—U. S. Eng., Standard Oil Bldg., Baltimore, Md., addnl. facilities, Contr. 18-020-Eng-87, Mercer Co., to P. W. Glenn, Sharon, **$200,000.** CD 9/8—ENR 9/16.

†**R. I., Quonset Point**—DIRECTION FINDER HOUSES, etc.—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., direction finder houses and pump house, NAS, Conanicut Is., NOY 6672, to Platt Contracting Co., 169 Bridge St., Cambridge, Mass., **$34,700.**

†**South Carolina**—IMPROVEMENTS—U. S. Eng., 33 Customhouse, Charleston, imprvs., addnl. bldgs., Greenville Co., to M. B. Kahn Constr. Co., Columbia. Bids 10/6. CD 9/28—ENR 9/30.

†**S. C., Charleston**—COAL STORAGE FACILITIES—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., open coal storage facilities, Navy Yard, NOY 7340, to C. Y. Thomason Co., Greenwood, **$46,258.**

†**Texas**—CONSTRUCTION—U. S. Eng., Fort Sam Houston, addnl. construction, utilities, facilities, etc., Coryell and Bastrop Counties, to Hale & Ricks, Bastrop, **$41,547.** CD 10/7—ENR 10/14.

†**Texas**—GASOLINE TRANSFER & FUEL LINES—U. S. Eng., Fort Sam Houston, gasoline transfer line and fuel line extens., Bexar Co., to Aqua System, Inc., 383 Gerard Ave., New York, N. Y., approx. **$40,000.**

†**Texas**—GRASSING and GROUNDS DEVELOPMENT—U. S. Eng., 25 St. and Avenue F, Galveston, grassing, grounds development, Brazos Co., to J. C. Griffith Co., M. Blanchard Bldg., Shreveport, La., **$25,000.**

†**Texas** — IMPROVEMENTS — U. S. Eng., Fort Sam Houston, imprvs., bldgs., storage facilities, Taylor Co., to Rose & Oates, 1110 Walnut St., Abilene, **$48,000.** CD 10/7—ENR 10/14.

†**Texas** — IMPROVEMENTS — U. S. Eng., Fort Sam Houston, imprvs., Webb Co., to H. B. Zachry Co., P. O. Box 596, San Antonio, over **$31,000.**

†**Texas**—IMPROVEMENTS—U. S. Eng., 25 St. and Avenue F, Galveston, imprvs., asphalt and concrete paving, Cameron Co., to H. B. Zachry Co., P. O. Box 596, San Antonio, **$255,000.**

†**Texas**—IMPROVEMENTS—U. S. Eng., 25 St. and Avenue F, Galveston, imprvs., addnl. concrete paving, McLennan Co., to Texas Bitulithic Co., Washington St., Houston, **$275,000.** CD 10/14.

Tex., Houston—LOADING PLATFORMS—General Foods Products Co., 2017 Preston St., heavy timber, concrete loading platform, conveyor sys., storage, etc., to P. M. Marshall, 2216 Congress St., approx. **$30,000.**

†**Va., Camp Bradford**—RAILROAD SPUR, etc.—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., railroad spur and coal handling facilities, NOY 7395, to Rust Engineering Co., Clark Bldg., Pittsburgh, Pa., **$114,300.**

†**Washington**—CLEARING—U. S. Eng., 1[illegible] 3 Ave., Seattle, Zone 4, clearing, Clallam Co., to A. C. Goerig Constr. Co., 1103 Vance Bldg., Seattle, Zone 1, **$50,000.**

★**Washington**—SHIPYARD BLDGS., etc.—Everett-Pacific Co., warehouse, machine shop, electric shop, locker room, personnel bldg., smith and forge shop, railroad, paving, sewers, water mains, addn. facilities at shipyard to P. N. Odegard, Everett, $334,[illegible] CD 5/12—ENR 5/20.

UNCLASSIFIED (Contracts Awarded, Cont'd.)

★ †**Washington** — TRANSMISSION LINE CONDUCTOR, etc.—Bonneville Power Admin., P. O. Box 3537, Portland, 8, Ore., 2,000,000 ft. steel-reinforced aluminum conductor and accessories for transmission line between Grand Coulee and Covington, to Aluminum Co. of America, Massena, N. Y., $608,-515.

★ †**Alaska**—IMPROVEMENTS—U. S. Eng., 300 I Ave., Seattle 4, Wash., imprvs., bldgs., to Morrison-Knudsen Co. Inc., 319 Bway., Boise, Idaho, $3,000,000.

LATIN AMERICA

Argentina—Government of Argentina, San Jose, plans hospital 2,000,000 pesos and paving various locations 32,725,041 pesos both in Buenos Aires; industrial building 1,000,000 pesos and aerodromes 259,800 pesos, at Chanel; legislative library at San Fernando 1,000,000 pesos; and school buildings in various locations 9,726,561 pesos.

Brazil—Government of Brazil, Rio de Janeiro, awarded contract constructing Victoria Minas Railway, to Morrison-Knudsen Co., 319 Bway., Boise, Idaho, U. S. A., to exceed $6,000,000. CD 11/16/42—ENR 11/19/42.

Chihuahua, Ciudad Juarez—Municipal Government, Palacio Municipal, plans improving water and drainage sys., steet paving and schools, $410,000. City has loan from Natl. Urbanization & Pub. Wks. Bank, Mexico City.

Costa Rica—Republic of Costa Rica, San Jose, will construct 72 mi. Inter-American Hy. from Cartago and San Isidro, incl. 13,000,000 cu. yd. excav., 6 tunnels, 800 culverts, etc. by force account and subcontracts. Est. $15,000,000.

Mexico—City of Cuetzalan, Puebla, takes bids within 60 days, new city hall. $250,000.

Mexico—Federal Govt. and States of Baja, Campeche, Coahuila, Colima, Chiapas, Chihuahua, Querrero, Guantajuato, Jalisco, Morelos, Nayarit, Nuevo Leon, Sinaloa, Sonora, Tobasco, Zacatecas and Oaxaca (Supervision Federal Health Dpt.), National Palace, Mexico City, plan water systems, drainage, etc., in above states. $1,294,000.

Mexico—Mexican Federal Govt., Govt. Palace, Mexico, plans hospitals in **Obregon**, Sonora state, **Torreon** in Coahuila, **Monclova** in Coahuila, **Martinez de la Torres**, Vera Cruz and another in **Maxicali** (lower California) valley, site not yet chosen, $850,000. Govt. and States own jointly.

Mexico—State of Colima, M. Gudino, governor, Govt. Palace, Colima, plans canal from Tazanillo to **Cuyutlen**, incl. new wharfs, piers, etc. $750,000.

Mexico—Espectaculos, S. A. (President Don Vicente Villasana), Tampico, Tamaulipas, plans by Arthur Oliveres Cedeno, Tampico, Tamaulipas, and receives bids within 60 days, modern theatre, complete refrigeration units, etc., **Madero**, state of Tamaulipas. $180,000.

Mexico—Espectaculos, S. A. (President Don Vicente Villasana), Tampico, Tamaulipas, plans by Arthur Oliveres Cedeno, Tampico, Tamaulipas, and takes bids within 60 days, modern theatre right off town plaza, containing refrigeration unit, **Tampico**, state of Tamaulipas. $250,000.

Mexico—Federal Dpt. Public Works, National Palace, Mexico City, will repair bridges, streets, roads, houses, etc., near **Mazatlan**, states of Sinaloa and Nayarit, own forces. $50,000.

Mexico—City of Juarez, Municipal Hall, Juarez, state of Chihuahua, plans new sewage plant, **Juarez**, Chihuahua state. $250,000.

Mexico, Mexico City—Federal District, Rojo Gomez, mayor, Municipal Bldg., Mexico City, takes bids January, 1944, school, incl. playgrounds, gymnasium, etc., in Villa Madera dist. $150,000.

Mexico, Guanajuato — Guanajuato Government, Palacio del Estado, Guanajuato City, plans chain of small dams to irrigate 450,000 acres. $960,000.

Mexico, Monclova—City of Monclova, Municipal Bldg., plans water sys. $150,000.

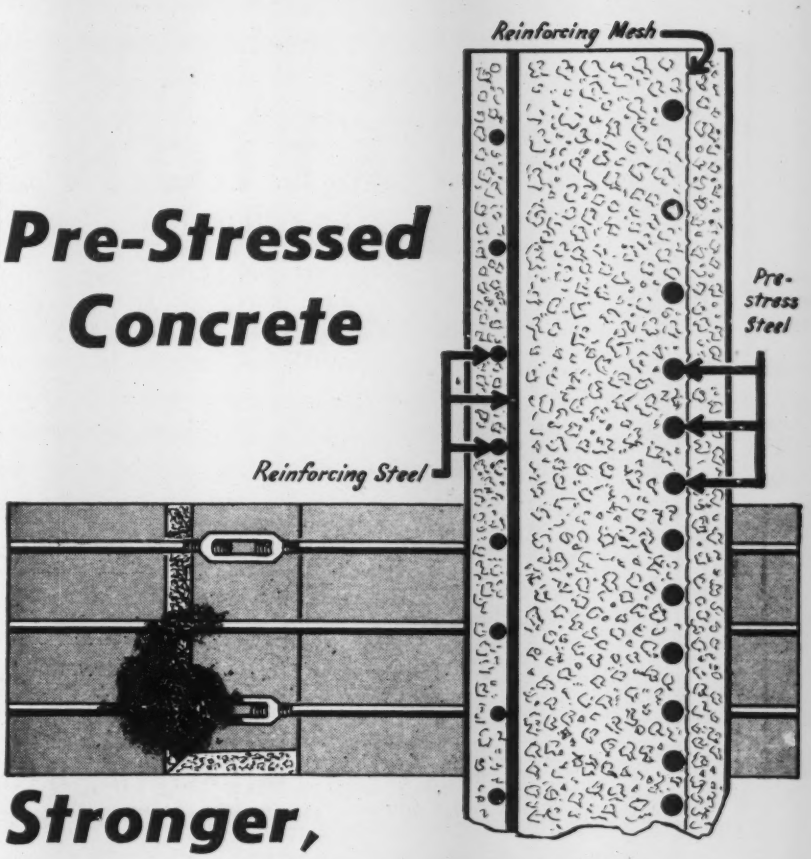
Mexico, Monterrey—State of Monterrey (Sec. Pub. Assistance), Govt. Palace, Monterrey, receives bids about Jan. 1, nurses' home and school as annex to the Dr. Jose Eleuterio Gonzales Hospital, $150,000.

Mexico, Monterrey—Mexico National Railway Sys, Mexico City, plans railway yards expansion and imprvs., incl. 12 new tracks.

Mexico, Tepic — City, Palacio Municipal, Tepic, Nayarit, awarded contract street paving, to La Estrella Contg. Co., Tepic. Est. $210,000. State has loan from Natl. Urbanization & Pub. Wks. Bank, Mexico City.

Mexico, San Luis—National Railways of Mexico, L. Reinam, ch. engr., Mexico City, plans expanding, improving railway yards and station.

Mexico, Zumpango—State of Mexico, I. Labeia, governor, Govt. Palace, Toluca, receives bids within 30 days water sys. $50,000.



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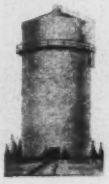

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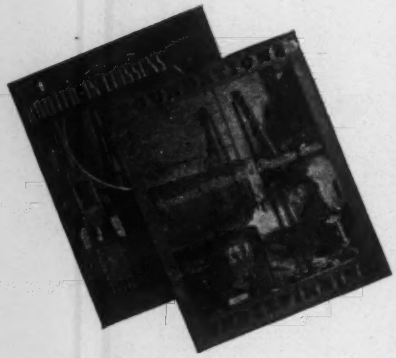

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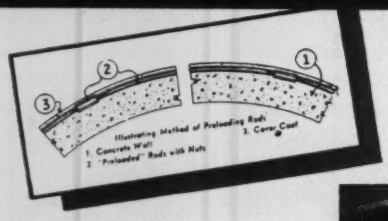

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PUBLIC BUILDINGS

PROPOSED WORK

★ †**Alabama**—Goodyear Tire & Rubber Co., Gadsden, plans by Roberts & Co., Inc., Allen Bldg., Atlanta, Ga., factory bldg., $1,000,000. Federally financed.

†**Alabama**—Rheem Mfg. Co., 2901 32 Ave. N., Birmingham, plans by D. O. Whitlock, Empire Bldg., Birmingham, new bldg. & altering present bldg. $425,000. Defense Plant Corp. will finance. CD 9/21—ENR 9/30

†**California**—U. S. Eng., 1209 8 St., Sacramento, Zone 8, bldgs., Spec. 702, Contra Costa Co. $75,000.

†**California**—U. S. Eng., 74 New Montgomery St., San Francisco, bldgs., central California, Spec. 1085.

†**California**—U. S. Eng., 74 New Montgomery St., San Francisco, bldgs., northern California, Spec. 1073-3.

†**Calif., Camp Roberts**—Home Owners' Loan Corp., Pacific Bldg., San Francisco, 50 family unit conversion program.

†**Calif., Lancaster**—Pub. Housing Auth., NHA, 785 Market St., San Francisco, 40 family dwelling units, Calif. 4775.

Conn., Bridgeport—City, two 2 story, brick fire stations, 1 at Old Town Rd. and Sylvan Ave., and other at Evers St. and Huntington Turnpike, $80,000. Applied for FWA funds.

†**Ill., Moline**—City, c/o A. Henry Arp, mayor, City Hall, brick, rein.-con. addn. to Moline Public Hospital Nurses Home. $180,928. **FWA.** CD 6/30—ENR 7/8.

†**Indiana**—Continental Roll & Steel Foundry Co., East Chicago, addnl. plant facilities. Approx. $110,000. Defense Plant Corp. will finance.

†**Ind., Indianapolis**—Pub. Housing Auth., NHA, 201 N. Wells St., Chicago, Ill., 200 family dwelling units, (stop-gap type), Ind. 12178, 300 same type dwelling units Ind. 12179 and 200 same type dwelling units, Ind. 12180.

†**Kan., Kansas City**—Providence Hospital Assn., 18 and Barnett Sts., plans by Carr & Dean, 1220 R. A. Long Bldg., hospital expansion, Kan. 14-148. $300,000. **FWA.**

★ **La., Baton Rouge**—State Dpt. Institutions, c/o S. A. May, asst. dir., Negro Industrial School, $1,500,000.

†**La., Leesville**—Federal Works Agency, D and F Sts. N.W., Wash., D. C., plans nearing completion by Dunn & Quinn, 827 Hodges St., Lake Charles, brick, rein.-con. hospital. CD 9/27—ENR 9/30, under BA.

†**Maine**—Pub. Housing Auth., NHA, 20 School St., Boston, Mass., rejected bids Oct. 14, bldg., alterations. CD 10/7—ENR 9/4.

†**Me., Portland**—Pub. Housing Auth. NHA, 24 School St., Boston, Mass., 100 family dwelling units, Me. 17085.

†**Massachusetts**—Pub. Housing Auth. NHA, 24 School St., Boston, drainage, grading, sewerage facilities, housing, Mass. 1942, Tighe & Bond, 189 High St., Boston, engrs.

†**Michigan**—Pub. Housing Auth., NHA, 20 E. Ninth St., Cleveland, O., plans by Malcolmson, Caeder & Hammond, Inc., 1217 Griswold St., Detroit, temporary family dwelling units, Mich. 20212. CD 8/18—ENR 9/3.

†**Michigan**—Chrysler Corp., 341 Massachusetts St., Detroit, addnl. plant facilities, $420,000. Defense Plant Corp. will finance.

Mich., Homer—Homer Village School Dist. 1, plans by Lewis & Sarvis, Battle Creek, school. $267,500.

†**Minnesota and Wisconsin**—Home Owners' Loan Corp., Woodmen of the World Bldg., Omaha, Neb., 35 family unit conversion program in Duluth, Minn., and Superior, Wis.

★ †**Minnesota** — Northwestern Aeronautical Corp., Minneapolis, plant facilities. Approx. $800,000. Defense Plant Corp. will finance.

Minn., Minneapolis—Bd. P. Welfare, City Hall, 2 story nurses' home addn. at General Hospital, 6 Ave. S. and 5 St. $150,000. Will apply for federal grant. CD 10/8—ENR 10/21

★ **Mo., Kansas City**—St. Lukes Hospital, 44 and Mill Creek, plans by Keene & Simpson, Land Bank Bldg., hospital and nurses' home bldgs., hospital. $1,030,000. Applied for FWA funds.

★ †**New Jersey**—Heyden Chemical Corp., 51 Union Square, New York, N. Y., plant facilities. Approx. $900,000. Defense Plant Corp. will finance.

†**N. J., Penns Grove**—Home Owners' Loan Corp., 2 Park Ave., New York, N. Y., 50 family unit conversion program.

UBLIC BUILDINGS (Proposed Work, Cont'd.)

O., **Lakemore**—Bd. Educ., Springfield Rural ict., Mrs. Edna Marshall, clk., Lakemore, and election Nov. 2, high school addn. 40,000.

Okla., **Enid**—Bd. Educ., Enid, high school ldg., facilities, $300,000.

Oregon—Pub. Housing Auth., NHA, Skin- r Bldg., Seattle, Wash., dwelling units.

Oregon—Pub. Housing Auth., NHA, Skin- r Bldg., Seattle, Wash., housing units.

Ore., **Forest Grove**—Pub. Housing Auth., HA, Skinner Bldg., Fifth Ave. and Union , Seattle, Wash., 25 family trailers, Cre. 285.

Ore., **Molalla**—Pub. Housing Auth., NHA, inner Bldg., Fifth Ave. and Union St., eattle, Wash., 40 family dwelling units, Ore 286 and 25 trailers, Ore. 35287.

Pennsylvania—Yards & Docks, Navy Dpt., St. and Constitution Ave. N.W., Wash., C. bldg., NOY 7776. Jaros, Baum & Bolles, 5 Lexington Ave., New York, N. Y., engrs.

Pa., **Bethlehem**—Bethlehem School Bd., $62,000. Federally financed. hool.

Pa., **Chester Twp.**—Chester Twp. School dg., 1 story, school, $66,412. **FWA.**

Pa., **Lancaster** — Home Owners' Loan rp., 2 Park Ave., New York, N. Y., 50 fam- unit conversion program.

Pa., **Pittsburgh**—Ohio Valley General Hos- tal plans by P. C. Dowler, 803 Century dg., hospital. $200,000. **FWA.**

S. C., **Charleston**—Medical Society of South Carolina, Roper Hospital, new bids on 7 story, bsmnt. Roper Hospital addn., 28-129. $1,100,000. **FWA.** Samuel Hanford & Sons, Dixie Terminal Bldg., Cincinnati, O., archts. CD 10/4—ENR 10/7.

S. D., **Ardmore**—Electric light plant.

Tennessee—Pub. Housing Auth., NHA, orgia Savings Bank Bldg., Atlanta, Ga., ans by E. M. Tisdale, Warner Bldg., Nash- lle, family dwelling units.

Tenn., **Bolivar**—State Dpt. Institutions, c/o W. O. Baird, comr., Nashville, plans by Frazier Smith, Goodwyn Institute, Bldg., mphis, Western State Hospital addn., prvs., repairs. $150,000-$300,000.

Texas—Pub. Housing Auth., NHA, 1205 ctric Bldg., Seventh and Taylor Sts., Fort rth, plans by Christensen & Christensen, omas Bldg., Dallas, family dwelling units, x. 41610. CD 10/8—ENR 10/14.

Texas—Pub. Housing Auth., NHA, 1205 ctric Bldg., Seventh and Taylor Sts., Fort rth, plans by Harvin Moore & J. Ward, 8 W. Alabama Ave., Houston, family elling units, Tex. 41-614; plans by R. R. pp & F. Stafford, Guaranty Bldg., Gal- ston, and Donald Barthelme & Associates, Stuart St., Houston, family dwelling units, x. 41-623; plans by G. Rustay, A. K. Stone J. Finger, Electric Bldg., Houston, fam- dwelling units, Tex. 41-615. CD 9/29— R 10/7.

Texas—U. S. Eng., Fort Sam Houston, gs. Bexar Co.

Tex., **LaPorte**—Bd. Educ., City Hall, plans Hedrick & Lindsley, 818 Southern Standard dg., Houston, school, incl. laboratory units, x. 41-631. **FWA.** CD 8/13—ENR 8/19.

Va., **Roanoke**—Veterans Admin., Vermont Ave. between H and I Sts. N.W., Wash., C., sketches hospital. $800,000.

Que., **Montreal**—Dom. Government, c/o Ministry of Munitions & Supply, Ottawa, t., plans by Ross & MacDonald, 1010 W. Catherine St., plant for mfg. penicillin. er $1,000,000.

DS ASKED

Bids Asked After October 18

Connecticut—Pub. Housing Auth., NHA, School St., Boston, Mass., sewage treat- nt and collection sys., Conn. 6083 and 6084. tended date. Plans deposit $50 for first and $10 for ea. addnl. set. Payne & efe, 231 State St., New London, archts. 10/12—ENR 10/14.

Bids Asked After October 19

Pennsylvania — Allegheny Co. Housing th., 201 County Bldg., Pittsburgh, com- nity bldg., housing, Pa. 36181, for NHA. ns deposit $25. CD 9/30—ENR 10/7.

Bids Asked After October 20

S. D., **Provo**—Pub. Bldgs. Admin., 18 and Sts. N.W., Wash., 25, D. C., grade and h school. **FWA.** P. C. Bettenburg & Co., 7 Marshall Ave., St. Paul, 4, Minn., archts. 9/8—ENR 9/16.

Bids Asked After October 22

Pennsylvania—Pub. Housing Auth., NHA, Bway., New York, 7, N. Y., community commercial bldgs., housing, Pa. 36251. ns deposit $10. Silverman & Levy, 1700 som St., Phila., archts. CD 7/14—ENR

Bids Asked October 25

N. H., **Portsmouth**—Federal Works Agen- 49 Chauncy St., Boston, Mass., altering ating U. S. O. bldg. Plans deposit $10. 7/19—ENR 7/22.

Va., **Newport News** — Federal Works ncy., 601 State-Planters Bank Bldg., hmond, Zone 19, 4 story police adminis- tion bldg. and jail, Va. 44-129. Plans de- it $25. Williams, Colle & Pipino, 408 son Bldg., archts.

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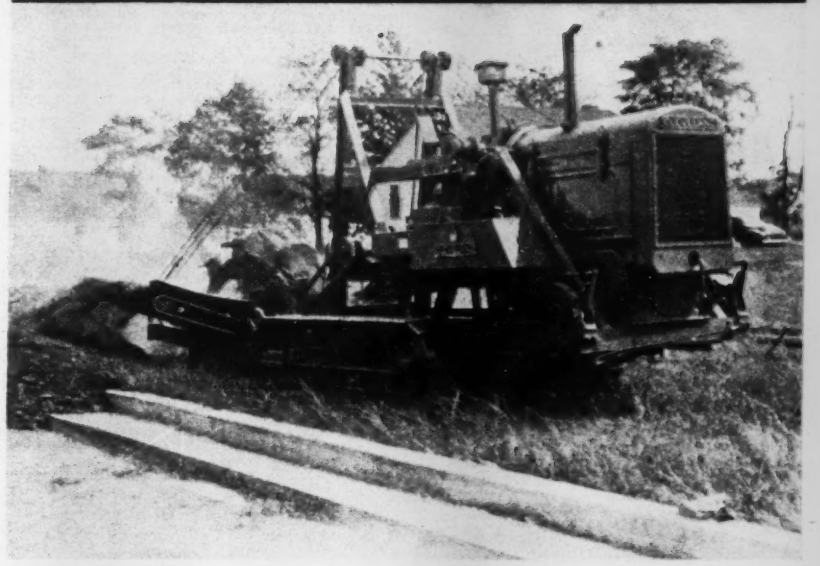

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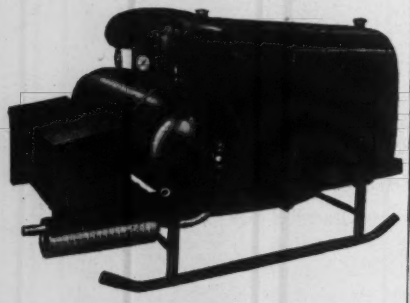

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PUBLIC BUILDINGS (Bids Asked, Cont'd.)

†**Va., Gravelly Point**—Pub. Bldgs. Admin., 18 and F Sts. N.W., Wash., D. C., airlines operations bldg.

Bids Asked After October 25

†**Pennsylvania** — Allegheny Co. Housing Auth., 201 County Office Bldg., Pittsburgh, community bldg., housing, Pa. 36151, for NHA. Extended date. Plans deposit $25. CD 10/13.

†**Pennsylvania**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., community bldg., housing, Pa. 36031. Plans deposit $10. Clarence Wagner, 133 W. 4 St., Williamsport, archt. CD 9/9—ENR 9/16.

Bids Asked October 26

†**Connecticut**—Bristol Housing Auth., New Cambridge Park, Bristol, family dwelling units, Conn. 6205 and 6207, for NHA. Extended date. Plans deposit $50 for first set and $10 for ea. addnl. set. Hayden & Loomis, 175 Main St., Bristol, archts. CD 10/14.

Bids Asked October 27

†**Alabama**—Pub. Housing Auth., NHA, Georgia Savings Bank Bldg., Peachtree and Broad Sts., Atlanta, Ga., commercial bldg., Ala. 1036. Sayward & Logan, Palmer Bldg., Atlanta, Ga., archts.

†**New Jersey**—Pub. Housing Auth., NHA, 270 Bway, New York, 7, N. Y., store bldg., NJ 28101. Extended date. Plans deposit $10. S. Schenker, 195 Van Houten St., Paterson, archt. CD 10/14—ENR 10/17.

†**Okla., Lawton**—R. E. Glenn, mayor, health center, Okla. 34-188. $50,000. **FWA.** Plans deposit $25. E. H. Durkee, Norman, engr. CD 10/5—ENR 10/7.

N. Y., Kings Park—Comr. Mental Hygiene, State Office Bldg., Albany, steam service tunnels, Veteran's Group, Kings Park State Hospital, Spec. 11612. $105,000. Plans deposit $15. Extended date. CD 9/20—ENR 9/23.

Bids Asked October 28

†**Del., New Castle**—Federal Works Agency, 601 State Planters Bank Bldg., Richmond, 19, Va., 1 story school bldg., Del. 7-109. G. Morris Whiteside II, Du Pont Bldg., Wilmington, archt.

†**Maine**—U. S. Eng., 131 St. James Ave., Boston, Mass., recreational center, alterations, addns., Cumberland Co.

Bids Asked October 29

†**Colorado**—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., Kansas City, Mo., dwelling units, Colo. 5108. T. H. Buell & Co., 730 14 St., Denver, engrs.-archts. CD 10/8.

†**Ohio**—Pub. Housing Auth., NHA, 2073 E. 9 St., Cleveland, temporary frame dormitory housing, Ohio 33286. Extended date. CD 10/11—ENR 10/14.

†**Tenn., Memphis**—Bd. Educ., 2 story, 16 classroom, rein.-con., brick Treadwell High School, $164,000. **FWA.** Furbringer & Ehrman, U. P. Bank Bldg., archts. CD 9/13—ENR 9/16.

†**Texas**—Pub. Housing Auth., NHA, 1205 Electric Bldg., Seventh and Taylor Sts., Fort Worth, temporary and permanent dwelling units, Tex. 41-598. Plans deposit $50. Hedrick & Lindsley and L. C. Ellis, 818 Southern Standard Bldg., Houston, archts. CD 10/6—ENR 10/14.

Bids Asked November 1

†**California**—Housing Auth. of City of Los Angeles, 1401 E. 1 St., Los Angeles, family dwelling units, Calif. 4780, for NHA. P. R. Williams, 1271 W. 35 St., and A. Wilson, 607 Architects Bldg., Los Angeles, archts.

†**N. Y., Syracuse**—General Hospital of Syracuse, nurses training bldg., housing, N.Y. 30-214, **FWA.** T. Walker Gaggin, First Trust & Deposit Bldg., archt.

†**Va., Arlington**—Federal Works Agency, 18 and F Sts. N.W., Wash., D. C., high school, Va. 44-102, $280,000.

Bids Asked November 3

†**La., New Orleans**—R. O. Maestri, mayor, health center, La. 16-144 F. $131,000. **FWA.** Plans deposit $25. F. T. Daunis, City Hall, archt. CD 9/14—ENR 9/16.

Bids Asked November 4

†**Colorado**—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., Kansas City, Mo., family dwelling units, community bldg., Colo. 5109. T. H. Buell & Co., 730 14 St., Denver, engrs.-archts. CD 10/8.

Bids Asked November 5

†**North Carolina**—Pub. Housing Auth., NHA, Georgia Savings Bank Bldg., Peachtree and Broad Sts., Atlanta, Ga., water distr. sys. addns., for Housing, NC 31-27, 31029, 31073 and 31074. Plans deposit $50. Tentative date. J. N. Pease & Co., Inc., Johnston Bldg., Charlotte, engrs.-archts. CD 10/5—ENR 10/7.

†**Pennsylvania**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., family dwelling units, Pa. 36439. Plans deposit $20. Wm. L. Murray, 1100 N. Second St., Harrisburg, archt. CD 10/7—ENR 10/14.

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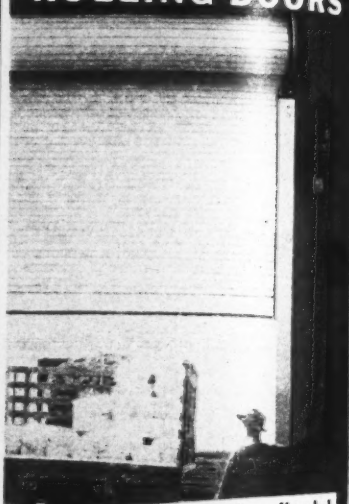

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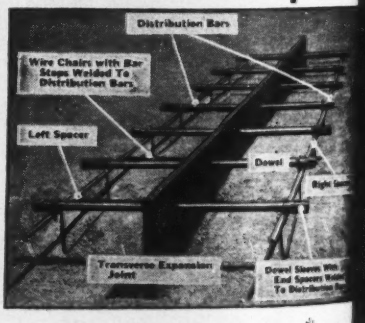

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UBLIC BUILDINGS (Bids Asked, Cont'd.)

Bids Asked November 9

†Va., **Portsmouth**—Federal Works Agency, 13 and F Sts. N.W., Wash., D. C., ospital and nurses home, Va. 44-272, $890,- James R. Edmunds, Jr., 409 Calvert dg., Baltimore, Md., archt. CD 9/28—ENR 28.

Bids Asked About November 10

†**Wash., Seattle**—Pub. Bldgs. Admin., 18 d F Sts. N.W., Wash., 25, D. C., Van Asselt hool addn., Docket 45-259-5; Cooper School ddn., Docket 42-259-3, Naramore & Brady, enter Horton Bldg., Zone 4, archts.; High oint School, Docket 45-259-1, Sturat, Kirk Durham, 4 and Cherry Bldg., Zone 4, rchts. FWA. CD 10/1—ENR 10/7.

Bids Asked November 12

†**Mich., Bay City**—Pub. Bldgs. Admin., 18 d F Sts. N.W., Wash., D. C., hospital, ich. 20-141. CD 5/28—ENR 6/3.

Bids Asked November 16

†**Ga., Augusta**—Veterans Admin., Vermont ve. between H and I Sts. N.W., Wash., D. C., P. Infirmary Bldg. 76. Extended date. CD /2—ENR 9/9.

Bids Asked November 23

†**Ky., Lexington**—Veterans Admin., Vermont Ave. between H and I Sts. N.W., Wash., C., infirmary bldg., connecting corridors.

Bids Asked

†**Massachusetts**—U. S. Eng., 131 St. James ve., Boston, (selected bidders), temporary dgs., No. 19-023-44-Neg-86, temporary bldgs., o. 19-023-44-Neg-89, both Suffolk Co.

†**Rhode Island**—U. S. Eng., 819 Industrial rust Bldg., Providence, (selected bidders), dgs., No. 44-42, Providence Co.

†**Rhode Island**—U. S. Eng., 819 Industrial rust Bldg., Providence, (selected list bidders), bldg., bldg. addn., No. 44-46, Newport o.

OW BIDDERS

†**California**—Housing Auth. of San Joaquin, 21 N. El Dorado St., Stockton, Oct. 5, family welling units, Calif. 4756 for NHA, from hepherd & Green, 309 First National Bank dg., Stockton, $419,915. CD 9/8—ENR 9/9.

†**District of Columbia**—Pub. Housing Auth., HA, Temporary Bldg. 2, 19 and D Sts. N.W., ash., Oct. 7, street paving and gutters at rkside Dwellings DC 1-11, from Potts & alahan Constr. Co., 600 W. 29 St., Baltiore, Md., $63,300.

†**Florida**—Pub. Housing Auth., NHA, eorgia Savings Bank Bldg., Peachtree and oad Sts., Atlanta, Ga., family dwelling nits, Fla. 8227, from W. Aldred, Statesboro, ., frame $238,000. masonry $239,800. CD /14.

†**Fla., Panama City**—Pub. Bldgs. Admin., and F Sts. N.W., Wash., D. C., Sept. 28, hool, Fla. 8-268, from H. J. Koski, Selma, ., $169,975. FWA. CD 9/30—ENR 10/7 der LB.

†**Ohio**—Pub. Housing Auth., NHA, 2073 E. Ninth St., Cleveland, Oct. 9, temporary mily dwelling units, Ohio 33266, frame, dry all, from Welso Constr. Co., 2233 W. Grant ., $1,545,945***frame, plastered, from Carl Erickson Co., 4753 N. Bway., Chicago, Ill., ,670,000***prefabricated, from John A. Johnn Co., 263-41 St., Brooklyn, N. Y., $1,529,000. D 9/22—ENR 9/30.

†**Texas**—Pub. Housing Auth., NHA, 1205 lectric Bldg., Seventh and Taylor Sts., Fort orth, Oct. 11, family dwelling units, facilies, utilities, site imprvs., Tex. 41-612, from cCann Constr. Co., 300 S. Main St., Fort orth, $77,500. CD 9/30.

Tex., Borger—Hutchinson Co., Oct. 11, hosital from Neil Singleton, 512 N. Fillmore St., marillo. CD 10/6.

†**New Mexico**—Pub. Housing Auth., NHA, 05 Electric Bldg., 7 and Taylor Sts., Fort orth, Tex., Oct. 15, 125 unit family housing, 29166, from C. H. Leavell, El Paso, Tex., 0,950. CD 10/5—ENR 10/7.

NTRACTS AWARDED

†**Alabama**—U. S. Eng., Grant St. west of eatwood St., Mobile, bldgs., Inv. 569-44-60, ontgomery Co., to Max D. Saxon, 210 Coosa Montgomery. Est. $40,000. Bids 9/17. 9/9.

†**California**—San Bernardino Co. Housing th., 125 Cluster St., San Bernardino, family dwelling units, Calif. 4578, for NHA, to J. Daum, 6803 West Blvd., Inglewood, 4,596. Bids 10/5. CD 8/31—ENR 9/2.

†**California**—U. S. Eng., 74 New Montgomry St., San Francisco, addnl. cold storage cilities. Spec. 964-A, San Francisco Co., to F. Lyon, 3348 Grand Ave., Oakland. Est. r $90,000. Awarded 10/12. CD 10/11—NR 10/14.

†**California**—Pub. Housing Auth., 785 Market St., San Francisco, family dwelling its, community bldg., Calif. 4747, to L. F. w Co., 8465 Melrose Ave., Los Angeles, 00,000. Bids 10/9. CD 10/15, under LB—NR 9/30.

†**California**—U. S. Eng., 751 S. Figueroa St., s Angeles, Zone 14, bldg., No. 206, to King McKee, 2250 El Cajon Blvd., San Diego, 00-$50,000.

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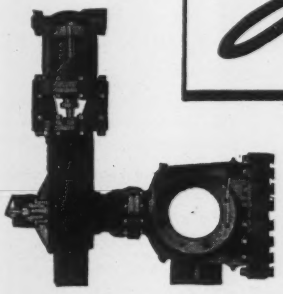

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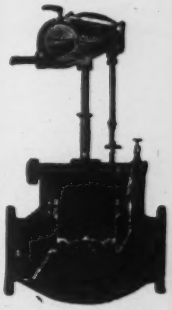

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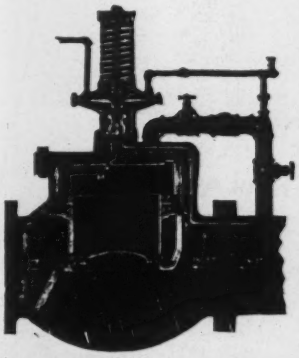

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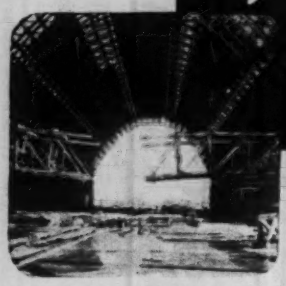

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PUBLIC BUILDINGS (Contracts Awarded Cont'd.)

†**Calif., San Diego**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., addnl. heating, school facilities, Destroyer Base, Noy 6395, to Stanton-Reed Co. & J. W. Breedlove Corp., Box 2903, **$158,998.**

†**Calif., San Pedro**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., facilities extension, small craft training center, Roosevelt Base, Terminal Island, NOY 7402, to P. [illegible] Walker Co., 1[illegible] S. Flower St., Los Angeles, $783,000. CD 9/[illegible]—ENR 9/30.

†**Calif., South San Francisco**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N. W., Wash., D. C., shops, storehouse and administration bldg., Aux. Air Facility, Moffett Field, NOY 7271, to K. E. Parker Co., 215 Park St., San Francisco, $254,564.

†**Connecticut**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., bldg., Spec. 12027, NOY 7169, to N. Benvenuti & Sons, 16 Elm St., New London, **$100,000-$200,000.**

†**Connecticut**—Vought-Sikorsky Div. United Aircraft Corp., 550 Main St., Stratford, alterations 112x325 ft. factory, to Edwin Moss & Son, Inc., 555 Grant St., Bridgeport, $102,[illegible]. Defense Plant Corp. will finance.

★†**D. C., Bellevue**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., WAVES barracks, laboratory bldg., mess hall, power plant addn., research laboratory, NOY 7174, to Chas. H. Tompkins Co., 907 16 St. N.W., Wash., **$328,850**; temporary chemistry laboratory and recreation bldg., NOY 6862, to Ross Engr. Co., First National Bank Bldg., Wash., D. C., $383,[illegible].

†**Idaho**—U. S. Eng., 628 Pittock Blk., Portland, bldgs., appurtenant work, Ada Co., to J. O. Jordan & Son, 406 S. 6 St., Boise, **$170,000.** Bids 10/7.

★†**Indiana**—Phelps Dodge Corp., 40 Wall St., New York, N. Y., mfg. plant addn. and rehabilitation, to Henry Ericsson Co., [illegible] N. La Salle St., Chicago, Ill. Est. $13,000,[illegible] incl. equip. Defense Plant Corp. will finance. CD 9/17—ENR 9/23.

†**Iowa**—U. S. Eng., 1709 Jackson St., Omaha, Neb., Bldgs., Polk Co., to F. F. Vawter Co., 202 Old Colony Bldg., Des Moines, $50,000-$100,000.

★†**Ia., Knoxville**—Veterans Admin., Vermont Ave. between H and I Sts. N.W., Wash., D. C., hospital, to A. H. Proksch, Iron River, Mich., **$780,900.** Bids 10/12. CD 10/[illegible]

†**Kansas**—U. S. Eng., 10 E. 17 St., Kansas City, Mo., housing, Geary Co., to M. K. Eby, Wichita, under **$100,000.**

★†**Maryland**—Pub. Housing Auth., NHA, Temporary Bldg. 8, 19 and D Sts. N.W., Wash., D. C., housing, Md. 18261, 18262, 18[illegible] and 18264, to John A. Johnson & Sons, In[illegible] 268 41 St., Brooklyn, N. Y., $1,855,000. Bids 10/7. CD 10/11—ENR 10/14.

†**Massachusetts**—U. S. Eng., 131 St. James Ave., Boston, bldgs., No. 19-023-44-neg-[illegible], Barnstable Co., to F. Grande & Son Construction Co., 425 Bway, Everett. Est. **$80,000.** Bids 10/9.

★†**Nebraska**—Defense Plant Corp., 511 Vermont Ave. N.W., Wash., D. C., aluminum plant, to Peter Kiewit Sons Co., Omaha Nat[illegible] tional Bank Bldg., Omaha. Est. approx. **$1,500,000.** Anaconda Alloys Corp., subsidiary of Anaconda Copper Mining Co., 25 Bway, New York, N. Y., will operate. CD 9/17—ENR 9/23, under CA.

†**Mich., Grosse Ile**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave., N.W., Wash., D. C., addnl. heating plant, NAS, NOY 7837, to Davis Bros. Inc., 2621 Bagley Ave., Detroit, **$44,645.**

†**New Jersey**—U. S. Eng., 6 and Walnut Sts., Phila., Pa., bldg., Burlington Co., to Andrew Christenson & Sons, 1140 E. Jersey St., Elizabeth, **$50,000.**

†**New Jersey**—U. S. Eng., 120 Wall St., New York, 5, N. Y., heating sys. for bldgs., Hudson Co., to Frank Farrell Co., Inc., 269 Camden St., Newark, **$25,000.**

†**New Jersey**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., repair resurfacing streets, housing NJ 2807[illegible], Robert Bassert Sons, Inc., 206 First St., Newark, **$43,417.** CD 10/4—ENR 10/7.

★†**New Jersey**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., magazine storehouses, railroads and services, NAD, NOY 6768, to Cauldwell Wingate Co., Box 961, Asbury Park, $9,187,917. CD 8/[illegible] under CA.

★†**New York**—American Aviation Corp., P. O. Box, Jamestown, general contract [illegible] craft mfg. plant addn., to A. Friederich & Sons Co., 710 Lake Ave., Rochester $338,[illegible] Awarded about 10/11. Defense Plant Corp. will finance. CD 9/24—ENR 9/23.

★†**N. Y., Sampson**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C, 5,000 man group school, NOY 7292, to Woodcrest Constr. Co. & Roseff Bros., 369 Lexington Ave., New York, N. Y., $4,77[illegible] 990. CD 10/12, under CA.

†**Ohio**—U. S. Eng., 700 Union Guardian Bldg., Detroit, Mich., addnl. offices and shop space, Cuyahoga Co., to Hunkin-Conkey, 1740 E. 12 St., Cleveland.

PUBLIC BUILDINGS (Contracts Awarded, Cont'd.)

†Oklahoma—Pub. Housing Auth., NHA, 306 Electric Bldg., Seventh and Taylor Sts., Fort Worth, Tex., family dwelling units, Okla. 3015, to D. W. Quinn Constr. Co., Sinclair Bldg., Fort Worth, Tex., $443,500. Bids 10/2, awarded 10/9. CD 10/7.—ENR 10/14, under CB.

†R. I., Quonset Point—Yards & Docks, Navy Dept., 18 St. and Constitution Ave. N.W., Wash., D. C., 2 storehouses, Naval Air Station, NOY 7214, to O. Alhborg & Sons, Inc., Cranston, $124,345. CD 9/22, under CA.

†Tenn., Memphis—Yards and Docks, Navy Dept., 18 St. and Constitution Ave. N. W., Wash., D. C., paint storage facilities, A T T C, NOY 7290, to Dunn Constr. Co., Inc. and Polk-Smartt Paving Co., Millington, $118,541.

†Texas—Pub. Housing Auth., NHA, 1205 Electric Bldg., Seventh and Taylor Sts., Fort Wogh, family dwelling units, site work, utilities, etc., Tex. 41-611, to P. O'B. Montgomery, 912 S. Akard St., Dallas, $1,157,000. CD 10/12—ENR 10/14.

†Texas—Pub. Housing Auth., NHA, 1205 Electric Bldg., Seventh and Taylor Sts., Fort Worth, 500,000 gal. rein.-con. water storage tank, to R. P. Farnsworth Co., Orange, $34,600. CD 9/8—ENR 9/16.

†Utah—Defense Plant Corp., 811 Vermont Ave. N.W., Wash., D. C., housing, to T. E. Ryberg, Strong & Grant, Interurban Bldg., Salt Lake City, approx. $2,000,000. C. C. Holden, 570 Lexington Ave., New York, N. Y., archt.

†Va., Portsmouth—Yards & Docks, Navy Dept., 18 St. and Constitution Ave. N.W., Wash., D. C., auditorium for Group A Barracks, Norfolk Navy Yard, NOY 6451, to Allen J. Saville, Inc., P. O. Box 552, Portsmouth, $153,466.

†Washington—U. S. Eng., 800 Third Ave., Seattle, Zone 4, bldgs., King Co., to Johnson, Goetz & Brennan, 208 E. Pacific Co., Seattle, Zone 5, $60,000. CD 10/6—ENR 10/14.

†Wash., Seattle—King Co. Medical Service Corp., Orpheum Bldg., Zone 1, hospital bldgs., to Sound Constr. & Eng. Co., Northern Life Tower, Zone 1, $610,780. FWA. CD 10/12—ENR 10/14.

†Wyoming—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., Kansas City, Mo., community bldg., Wyo. 48085, housing Wyo. 48084, to P. J. Kirchhoff Const. Co., 706 Lawrence St., Denver, Colo., Proposal A plus C $668,830. Bids 10/12, awarded 10/14 CD 9/27—ENR 9/30.

COMMERCIAL BUILDINGS

PROPOSED WORK

Conn., Naugatuck—G. W. Cassidy, 111 West Main St., Waterbury, 200 or more housing units, Field, Penn and Quinn Sts. $700,000. FHA.

Minn., Duluth—St. Mary's Hospital, 429 E. 1 St., plans by P. O'Meara & Associates, 1709 Waterman St., St. Louis, Mo., hospital addn. $180,000. CD 10/6—ENR 10/14.

Neb., Omaha—Watson Bros. Transportation Co., 802 S. 14 St., truck terminal. $300,000.

N. C., Raleigh—Bd. Trustees, Meredith College, Wilmont Park, Raleigh, new bldgs., $350,000. W. H. Weatherspoon, 1703 St. Mary's St., pres. Bd. Trustees.

Ore., Portland—J. Zell, 639 S. W. Broadway, plans by Dougan & Helms, 409 Couch Bldg., converting bldg., to 13 apartment units, $300,000. CD 10/5—ENR 10/14.

Tex., Dallas—Methodist Hospital, c/o First Methodist Church, 1928 Ross St., nurses home, facilities. Applying for FWA funds.

Tex., Del Rio—House Plan Bureau, 412 Alamo Natl. Bldg., San Antonio, thirty-nine 1 story dwellings, utilities, $200,000.

Tex., San Marcos—San Marcos Housing Corp., 412 Alamo Natl. Bldg., San Antonio, forty-four 1 story dwellings, $200,000.

Wash., Auburn—Knowles Homes, Inc., Auburn, plans by W. R. Grant, Lloyd Bldg., Seattle, Zone 1, 47 dwelling units, $200,000.

Wash., Seattle—Olympic Hills Home Builders, Inc., c/o Stuart & Durham, archts., 4 and Cherry Bldg., Zone 4, 112 dwelling units, E. 145 St. and 25 Ave. N.E. $400,000.

CONTRACTS AWARDED

Calif., Compton—C. S. Larfield Constr. Co., 7225 Woodhaven Dr., Los Angeles, 35 frame, stucco dwellings. Owner builds, $150,000.

Calif., Gardena—H. V. Hunsaker & Associates, 670 LaFayette Park Pl., Los Angeles, 6 frame, stucco dwellings. Owner builds, $50,000.

Calif., Lakewood Village—J. M. Walker, Constr. Co., 1709 W. 8 St., Los Angeles, 40 frame, stucco dwellings. Owner builds. Over $500,000.

Calif., Montebello—Eastwood Village Housing Corp., 717 S. Ogden Dr., Los Angeles, 88 follow masonary block dwellings, to Assets Reconstruction Co., 937 Diamond St., Monrovia. Est. over $150,000. J. R. Friend, 132 W. 8 St., San Pedro, archt.

Calif., Ontario—S. V. Hunsaker & Associates, 670 Lafayette Park Pl., Los Angeles, 6 frame, stucco dwellings. Owner builds. $25,000. C. N. Aldrich, 1834 Dawson Ave., Long Beach, archt.

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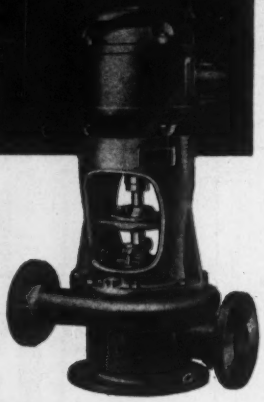

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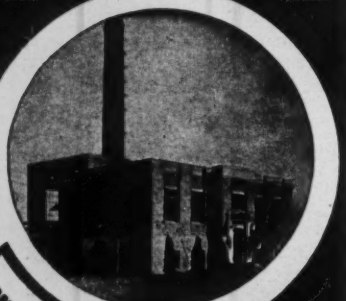

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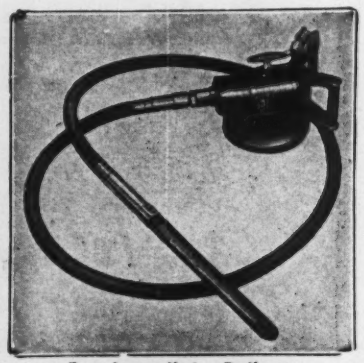

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Calif., Torrance—E. ...dine, 2021 Wa... ton Rd., Los Angeles, ... frame, stucco ... lings. Owner builds. Ov... $150,000.

★**Calif., Van Nuys**—L...raine M. Yates, contractor, two hundred forty-... frame, plaster double dwellings in Th... Constr. Co., 919 ... Angeles. Est. $1,900,000.

N. J., Newark—Union Irvington Land ... veloping Co., 1040 Springfield Ave., Irv... group 2 story, brick residences, separate ... tracts, $150,000. A. Silberstein, 24 William ... archt. CD 9/28—ENR 9/30.

N. J., Orange—Len ...Home Builders, ... Kearny Ave., North Arlington, 2 story, fr... brick veneer Edison Village apartments, ... rate contracts, $190,000. McMurray & Sch... lin, 968 Stuyvesant Ave., Union, archts. ... 9/28—ENR 9/30.

Pa., Erie—Keystone Associates, J. M... man, chg., 1010 Arrott Bldg., Pittsb... seventy-five 2 story, bsmt., 20x26 ft., ... residences in Southlands, separate contr... $350,000. W. C. Young, 524 4 Ave., Pittsb... archts.

Tex., Brownsville—G. A. Jackson & D... 5206 Alcott St., Dallas, 109 asbestos ... dwelling units. Owner builds. $425,000. ... 10/6—ENR 10/14.

★**Tex., Dallas**—Murray Investment Co., ... public Bank Bldg., 147 dwellings. O... builds. Approx. $585,000. FHA. CD ... —ENR 10/14.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Kan., Wellington — MILL — Hunter M... Wellington, rebuilding mill destroyed by ... Over $40,000

★**Neb., Lincoln**—PLANT—Goodyear Tire ... Rubber Co., 1144 E. Market St., Ak... O., improv., equipping former Patriot Tr... plant for mfg. self-sealing fuel tanks ... planes, $500,000.

O., Cleveland—FACTORY—W. S. Ferry ... Co., archt., 2362 Euclid Ave., 1 story, 90... ft., brick, steel factory bldg., for Victo... Instrument Co., J. A. Victoreen, pres., ... Hough Ave. $100,000. CD 9/22—ENR 9/30

★**Ore., Salem** — PLANT — Amer. Can ... P. M. Yost, mgr., Eliot and Vine ... Seattle, Wash., factory on 28 acre site. $1,0... 000.

★**Tex., Texas City** — PLANT — Monsa... Chemical Co., 1700 S. Second St., St. L... 4, Mo., bids soon formaldehyde plant, $1,0... 000, incl. equipment.

Wis., Milwaukee—FACTORY—The Hell ... 3000 W. Montana St., 1 story, 206x242 ... brick factory, concrete fdn. $100,000. K... & Smith Co., 111 E. Wisconsin Ave., Zone ... engrs and archts.

BIDS ASKED

Wis., West Bend—FOUNDRY—V. H. Ba... archt., 4061 N. Prospect Ave., Milwauk... Zone 11, 2 story, 60x80 ft., brick foun... addn., concrete fdn., for Gehl Bros. Mfg. ... 143 Water St. CD 9/14—ENR 9/16.

CONTRACTS AWARDED

Ill., Aurora—FACTORY—Barber-Greene ... 631 W. Park Ave., factory bldg., to Au... Co., 510 N. Dearborn St., Chicago. ... $100,000.

Mo., St. Louis — PLANT BLDG.—Sc... Steel Co., 6700 Manchester Ave., Zone ... general contract 2 and 3 story, brick, re... con. office bldg. for steel plant, Manches... Ave., between Waldemar and Kraft Av... to H. B. Deal & Co., Inc., 1218 Olive St., ... Louis, Zone 3. Est. $120,000. Paulnel... Schmidt, 6700 Manchester Ave., Zone ... archts.

Mo., St. Louis—SHOP BUILDINGS—... minal Railroad Assn. of St. Louis, 1916 ... ket St., Zone 3, 2 story, 53x57 ft., ... steel, frame blacksmith shop, and st... bldg., and 3 story, business bldg., own f... and sub contracts. Est. $40,000. CD 9/... 9/23.

N. J., Bloomfield—PLANT—Specialties ... Co., 35 Farrand St., mfg. bldg., to Wy... Kidde Constr. Co., 140 Cedar St., New Y... N. Y., $44,000. H. McDonnell, 101 Park ... New York, N. Y., archt.

N. J., Linden—PLANT—Standard Oil ... of N. J., Bayway Refinery, aviation fuel ... ing bldg., own forces, $110,000. J. Verner, ... way Refinery, Linden, archt.

O., New Philadelphia—PLANT—La... Conveyor & Mfg. Co., 338-348 S. Broad ... 80x160 ft. plant addn., to Wendling Bros., ... Dover, $50,000. Awarded 10/3.

O., Painesville—FACTORY—Clifton P... ucts Co., C. Windecker, pres. and genl. ... 1 story, 117x145 ft., brick, steel factory a... to E. J. Benes & Co., Terminal Tower, ... $100,000. McGeorge & Hargett, 9400 Q... Ave., engrs. and archts.

Tex., San Antonio—PLANT—Alamo Ba... Co. 803 Wyoming St., 90x130 ft. bakery ... day labor, $40,000. L. M. J. Dielmann, ... North St., archt. CD 10/11.

Wis., Brillion — FACTORY — Brillion ... Wks., Inc., Brillion, 1 story, 50x114 ft., fr... foundry bldg., concrete fdn., day labor, ... Schmitt, Two Rivers, archt.

Proposal Advertisements see p. 22...

Postwar Projects see p. 190

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OFFICIAL PROPOSALS

Bids: November 8, 1943 (189)

Electrical Work

SOUTH DISTRICT FILTRATION PLANT
DEPARTMENT OF PUBLIC WORKS
CITY OF CHICAGO
CHICAGO, October 15, 1943.

SEALED PROPOSALS will be received by the City of Chicago until 11 A.M. (Central War Time), Monday, November 8, 1943, at Room 406 City Hall, at which time and place all such proposals will be opened publicly and read, for furnishing all labor, materials, equipment and services necessary to perform certain Electrical Work in connection with the construction of the South District Filtration Plant, located on the lake front, east of South Shore Drive and north of East 79th Street, Chicago, Illinois, in accordance with plans and specifications on file in the office of the Department of Public Works of said City, Room 406 City Hall.

In general, said Electrical Work shall consist of furnishing and installing Switchgear, Switchboards, Motor-generator battery charging units, Copper-oxide battery charging units, Storage batteries and racks, Power and lighting transformers, Motor starting and control apparatus, Power and lighting cabinets, Grounding system, Lighting system, Power system, Control, signal and alarm system, Underground duct lines, also, connecting electrical apparatus furnished and installed under other contracts.

Proposals must be made out upon blanks furnished at said office, and be addressed to said Department, indorsed "Proposal for Electrical Work, South District Filtration Plant," and be accompanied with Fifteen Thousand Dollars ($15,000.00) in money or certified check for the same amount on some responsible bank located and doing business in the City of Chicago and made payable to the order of the Commissioner of Public Works.

Plans and specifications may be obtained upon payment of Fifty Dollars ($50.00) for each set, which will be refunded upon the return of said plans and specifications in good condition within thirty (30) days after the opening of bids. Deposits to be in the form of money or certified check.

In accordance with the provisions of the Act of the General Assembly of the State of Illinois, entitled "An Act regulating wages of laborers, mechanics and other workmen employed under contracts for public works," approved June 26, 1941, the general prevailing wage rates for work at the construction site are set forth in the specifications.

The Commissioner of Public Works reserves the right to reject any or all bids.

No proposal will be considered unless the party submitting the same shall furnish evidence satisfactory to the Commissioner of Public Works of ability, and the possession of the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications.

OSCAR E. HEWITT,
Commissioner of Public Works.

Bids: November 8, 1943 (190)

Freight Elevator

SOUTH DISTRICT FILTRATION PLANT
DEPARTMENT OF PUBLIC WORKS
CITY OF CHICAGO
CHICAGO, October 15, 1943.

SEALED PROPOSALS will be received by the City of Chicago until 11 A. M. (Central War Time), Monday, November 8, 1943, at Room 406, City Hall, at which time and place all such proposals will be opened publicly and read, for furnishing and erecting one (1) electrically-operated Freight Elevator, of the push-button controlled type, in the Chemical Building of the South District Filtration Plant, located on the lake front, each of South Shore Drive and north of East 79th Street, Chicago, Illinois, in accordance with plans and specifications on file in the office of the Department of Public Works of said City, Room 406, City Hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said Department, indorsed "Proposal for Freight Elevator, South District Filtration Plant," and be accompanied with Five Hundred Dollars ($500.00) in money or a certified check for the same amount on some responsible bank located and doing business in the City of Chicago and made payable to the order of the Commissioner of Public Works.

Plans and specifications may be obtained upon payment of Ten Dollars ($10.00) for each set, which will be refunded upon the return of said plans and specifications in good condition within thirty (30) days after the opening of bids. Deposits to be in the form of money or certified check.

In accordance with the provisions of the Act of the General Assembly of the State of Illinois, entitled "An Act regulating wages of laborers, mechanics and other workmen employed under contracts for public works," approved June 26, 1941, the general prevailing wage rates for work at the construction site are set forth in the specifications.

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OSCAR E. HEWITT,
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P-919, Engineering News-Record
330 W. 42nd St., New York 18, N. Y.

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P-931, Engineering News-Record
520 No. Michigan Ave., Chicago 11, Ill.

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P-890, Engineering News-Record
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P-930, Engineering News-Record
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GRADUATE ENGINEER, 18 years experience in Water supply, sewers, bridges, underground utilities, buildings. Desires position with Contractor or Engineer as Superintendent. Available immediately. PW-923. Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

CIVIL ENGINEER and Construction Executive. Immediately available. 30 years engineering, construction and management experience in responsible positions. Familiar with Government procedure and contracts. Capable taking complete charge of organization with projects. Desires responsible connection with future. PW-924, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

STRUCTURAL STEEL — ORNAMENTAL IRON plant executive desires change. Long experience in sales, estimating, engineering and management positions. Thoroughly acquainted with shop methods and production. Age 43, Registered Engineer. Location immaterial. PW-925, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

SANITARY ENGINEER — Graduate C. E. Fourteen years experience to assume responsible charge of design and supervision of water supply and sewerage systems including all structures and industrial buildings for related appurtenances. Available immediately. PW-932, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

ESTIMATOR ENGINEER, 30 years experience, in responsible charge many War, Navy & Housing Projects. PW-944, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

CONSTRUCTION ENGINEER — Executive, seeks position where twenty-five years of experience as a general contractor in private commercial construction, United States Army work and public work throughout the United States, will be of value. He is a college graduate, age 46, an excellent contact man, having good personality and ability to handle men. PW-934, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

HIGHWAY ENGINEER, Graduate C. E. Age 50 desires position on Highway planning for post war work. Ten years Highway Location and Construction. Ten years on Railroad Location, Construction and Maintenance. Available immediately. Will go anywhere. PW-937, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

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